



COMDTNOTE 16500
FEB 11 2005

COMMANDANT NOTICE 16500

Subj: CH-6 TO AIDS TO NAVIGATION MANUAL – TECHNICAL,
COMDTINST M16500.3A

1. PURPOSE. This Notice promulgates change 6 to the Aids to Navigation Manual, Technical COMDTINST M16500.3A.
2. ACTION. Area and district commanders, commanders of maintenance and logistics commands, commanding officers of civil engineering units, commanding officers of headquarters units, assistant commandants for directorates, Chief Counsel, and special staff offices at Headquarters shall ensure that the required changes are made to the manual. Internet release authorized.
3. PROCEDURE. The change consists of 47 pages. Remove & insert the following pages:

Remove

Table of Contents
2-27 and 2-28

Chapter 4

5-1 and 5-2
5-19 thru 5-22
6-3 and 6-4
6-7 and 6-8
6-13 thru 6-18
6-29 and 6-30
6-53 and 6-54
6-93 thru 6-127

7-21 and 7-22

Insert

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2-171 thru 2-174

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5-19 thru 5-22
6-3 and 6-4
6-7 and 6-8
6-13 thru 6-18
6-29 and 6-30
6-53 and 6-54
6-93 thru 6-127
7-14A
7-21 and 7-22

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NON-STANDARD DISTRIBUTION: *C:I D1-STA Burlington, D9-STA St. Ignace, and D11-STA Channel Islands Harbor only.

Remove

9-13 and 9-14
9-59 and 9-60
9-93 thru 9-96
9-99 thru 9-104
Index

Insert

9-13 and 9-14
9-59 and 9-60
9-93 thru 9-96
9-99 thru 9-104

- b. Units that have not received the Aids to Navigation Manual – Technical, COMDTINST M16500.3A, but have received this change may requisition a copy of the manual and changes 1 through 5 from the DOT Warehouse in accordance with the Directives, Publications and Report Index, COMDTNOTE 5600.
- c. Paper copies will be distributed to commands that deal directly with aids to navigation. An electronic version of this change is available at <http://isddc.dot.gov/>.

4. SUMMARY OF CHANGES.

- a. Chapter 2, Buoys and Moorings, is amended to clarify the expected service life of foam buoys and a job aid is added to assist units with the decision to retain or remove foam buoys from service.
- b. Chapter 4, Structures, is removed from the manual and is superseded by the Aids to Navigation Manual – Structures, COMDTINST M16500.25, which expands on the construction, inspection and safety aspects of Coast Guard structures.
- c. Chapter 5, Dayboards, is revised to clarify the retro color and dimensions on yellow special mark and ICW range dayboards, and add non-lateral dayboards for western rivers.
- d. Chapter 6, Light Signals, is revised to more closely reflect industry standard ratings for lamp life and incorporates new guidance on aid service intervals. This effectively increases the potential service interval for aids using C-8 marine signal lamps. The data sheet for the self contained LED lanterns is revised to include sizing tables for each model to assist in the proper selection for a given location.
- e. Chapter 7, Sound Signals, is revised to clarify the remote control wiring for FA-232/SA-850 sound signals
- f. Chapter 9, Power Systems, is amended to update the RBDT table for ice buoy batteries to reflect the new LED ice buoy lanterns, and adds updated battery data sheets.

5. ENVIRONMENTAL ASPECT and IMPACT CONSIDERATIONS. Environmental considerations were examined in the development of this directive and have been determined to be not applicable.

6. FORMS/REPORTS. None

P. J. GLAHE /s/
ACTING ASST COMMANDANT FOR SYSTEMS

Enclosure: (1) Change 6 to the Aids to Navigation Manual – Technical

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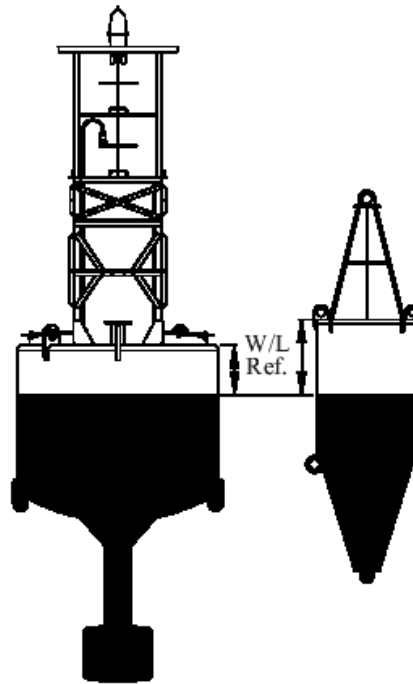


Table 2-11

STANDARD WATERLINES FOR STEEL BUOYS

Noted below are the standard waterlines which will be indicated on new steel buoys (line between color coat and antifouling paint). Used buoys should have the same waterlines except when used in areas where the buoy may ride much lower or higher than normal.

<u>STD Buoy Type</u>	<u>W/L (in.)</u>	<u>STD Buoy Type</u>	<u>W/L (in.)</u>
9X35 LWR	24	2NR/2CR	36
9X32 LR	30	3NR/3CR	24
9X20 R	18	3NI	60**
8X26 LR	24	3CI	54**
8X26 LWR	24	4NR/4CR	24
8X21 LR	24	5NR/5CR	24
7X20 LI	*	5CI	33**
7X17 LR	18	5NI	46**
6X20 LR	18	6NR/6CR	18
5X11 LR	12	6CT	24**
3.5X8 LR	9	6NT	40*
1NR/1CR	60	FOAM BUOYS	***

*Located at Largest Diameter

**Measured from Top Horizontal Surface

***Located half way between the top and bottom of the buoy hull (flotation foam)

2.F. Foam Buoys. The entire "family" of foam buoys was redesigned in 1996. The buoys now have a more robust structural framework, the lifting eyes are larger and stronger, the mooring eyes are similar in size to the equivalent steel buoy, and all assembly hardware is made of corrosion-resistant stainless steel. The color pigments and antioxidant additives in the foam have been increased to reduce fading. The new designs are sized to provide the same visual signal to the mariner as the equivalent class of steel buoy. However, foam buoys have a significantly higher life cycle cost than steel buoys. Foam buoys should only be used when there is a clear operational reason that makes them preferable to steel. An example would be a station where switching from steel to foam will permit changing the servicing platform from a buoy tender to a buoy boat. Also, foam buoys are generally not suitable for rugged environments, and should never be used in ice conditions. Foam buoys are designed to remain on station for eight years with minimal maintenance required. They may be kept on station beyond eight years if they remain serviceable and continue to provide the required signal. Data Sheet 2.N.1 is a job aid which is provided to assist field units in evaluating a foam buoy's condition to determine whether to leave it on station or relieve it.

1. Assembly of New Buoys. Foam buoys are shipped either unassembled or partly assembled, depending on the buoy type. Assembly instructions are included in the data sheets for each buoy type. In general, the following guidelines apply:
 - a. Upon receipt of new buoys, inspect for shipping damage and ensure all parts are accounted for.
 - b. The middle and bottom plates on new buoys are sometimes warped during the manufacturing process. This should not affect assembly of the buoy or its performance on station.
 - c. Assemble the buoys as soon as possible so that the parts are not lost.
 - d. Ensure that all connections are tightly secured. On the smaller buoys, the nuts shall be tightened until the metal plates are compressed at least 1/2 inch into the foam or until the elastic lock nuts ("Nylock") bottom out on the threads.
 - e. Always use new stainless steel elastic lock nuts to assemble the buoys. These nuts shall not be reused if they have been backed off. Once they have been tightened, do not loosen them.
2. Servicing. Foam buoys have been designed to require minimal servicing while on station. The following guidance applies:
 - a. Check for any loose connections and tighten if possible.
 - b. Use a pressure wash or scrub brush to remove growth, guano, etc.

2.N. Additional Guidance. Additional technical guidance is presented in this section.

2.N.1 Foam Buoy Job Aid

1. Purpose. The purpose of this Job Aid is to assist field units in evaluating a foam buoy's condition to determine whether to leave it on station or relieve it.
2. Background. Foam buoys are lightweight and durable, making them an important part of the aids to navigation inventory. However, they have a significantly higher lifecycle cost than steel buoys. If a decision is made to use a foam buoy, it is important to keep it on station as long as possible so the Coast Guard can get the most value out of its investment. Relieving and disposing of these buoys while they still have service life remaining is a waste of paid-for value.
3. Evaluation Procedure. Ask the following questions when evaluating a foam buoy:
 - a. Color: Is the buoy recognizable as red or green?
 - b. Foam condition: Can the daymark shape be identified as a can or nun? Does the buoy have sufficient stability and freeboard remaining to provide the required visual range for the aid?
 - c. Metalwork: Is the metalwork damaged to such an extent that it affects the operational performance of the buoy or presents a safety hazard when lifting or handling it?

Guidance to help answer these questions is provided below.

4. Color. Foam buoys will lose their color over time through fading, chalking, sun burn, and the accumulation of foreign materials (salt, dirt, guano, etc.). The important consideration is whether the signal color of the buoy can still be identified. To determine whether to leave a buoy on station or relieve it due to color loss, answer the following question:

- Is the buoy recognizable as red or green?

YES	Leave the buoy on station
NO	Relieve the buoy

- a. Examples. The blocks on the left show the approximate color of a new buoy. The blocks in the middle show buoys which are faded, but are still an acceptable color and should remain on station. The blocks on the right show buoys which are too faded, and should be relieved.

NEW BUOY COLOR



KEEP ON STATION



RELIEVE THE BUOY



NEW BUOY COLOR



KEEP ON STATION



RELIEVE THE BUOY



5. Foam Condition. Foam buoys can take considerable abuse and still provide the proper signal to the mariner. Cuts, tears, gouges, shredding, or even missing chunks of foam will rarely be enough to affect the performance of the buoy. The important considerations are whether the daymark shape can still be identified, and whether the buoy has sufficient stability and freeboard remaining to provide the required visual range for the aid. To determine whether to leave a buoy on station or relieve it due to foam damage, answer the following questions:

- | | | |
|---|-----|-------------------|
| • <u>Is the daymark shape identifiable as a can or nun?</u> | YES | Leave the buoy on |
| station | NO | Relieve the buoy |
| • <u>Does the buoy provide the required visual range?</u> | YES | Leave the buoy on |
| station | NO | Relieve the buoy |

- a. Examples. The buoys on the left are new buoys. The buoys in the middle have been in service. The daymark shapes are identifiable, they are stable, and they have adequate freeboard remaining. They should be kept on station. The buoys on the right have significant damage. The nun hull has been damaged enough to cause water intrusion and/or instability. The can daymark shape has been altered, the buoy is listing, and there is insufficient freeboard remaining. Both of these buoys should be relieved..

NEW BUOY



KEEP ON STATION



RELIEVE THE BUOY



NEW BUOY



KEEP ON STATION



RELIEVE THE BUOY



6. Metalwork. The metalwork of a foam buoy will deteriorate over time

through corrosion and normal wear-and-tear, or there may be damage from collisions. The important considerations are whether the metalwork can continue to hold the buoy together, and whether the buoy remains safe to lift and handle. To determine whether to leave a buoy on station or relieve it due to metalwork damage, answer the following questions:

- | | | |
|---|-----|---------------------------|
| • Is the connecting hardware loose, severely corroded, or missing? | YES | Relieve the buoy |
| | NO | Leave the buoy on station |
| • Is the lifting eye bent, stretched, twisted, excessively worn, or corroded? | YES | Relieve the buoy |
| | NO | Leave the buoy on station |
| • Are the welds cracked or broken? | YES | Relieve the buoy |
| | NO | Leave the buoy on station |
| • Is the counterweight tube bent or broken? | YES | Relieve the buoy |
| | NO | Leave the buoy on station |

- a. Examples. The metalwork on the left is new. The metalwork in the middle is slightly corroded, with some marine growth, but is still serviceable. It should be kept on station. The metalwork on the right has significant structural damage. It should be relieved.

NEW METAL WORK



KEEP ON STATION



RELIEVE THE BUOY



CHAPTER 5. DAYBOARDS

A. Introduction. Dayboards differ in size and markings depending on the marking system and specific function. There are three marking systems used in the U.S.: General Use; Intercoastal Waterway (ICW); and Western Rivers. All three are based on a Lateral System, wherein marks are used to define the edges of a channel. Not all marks within a lateral system will have lateral significance. Safe-water marks and special marks, for example, do not provide the mariner with guidance on which side the mark should be passed. This chapter describes dayboard characteristics and provides guidance for selecting, preparing, inspecting and maintaining dayboards.

B. Selection Guide.

1. Designations. Prior to selecting a dayboard, it is helpful to understand the standard designations and operational parameters. Every daymark, with the exception of information and regulatory marks, has a designator-composed of a numeral followed by a group of letters-which indicates its dimension, shape and color. The designator is constructed as follows:

- a. A NUMERAL gives the width of the dayboard in feet.
- b. The first LETTER refers to the shape or purpose of the dayboard.

S – square;
T – triangle;
J – preferred channel;
M – safe water;
N – no lateral significance;
K – range; and
C – crossing.

- c. The second LETTER represents the key color:

R – red;
G – green;
W – white; and
B – black.

5.B.1.

- d. The third LETTER indicates the color of stripe (range dayboards only):

R – red;
G – green;
W – white; and
B – black.

- e. Additional information is shown by LETTERS placed after the dash (-):

I – intracoastal waterway;
SY – yellow square on dayboard (dual purpose); and
TY – yellow triangle on dayboard (dual purpose).

As shown in Figure 5-1, a 6KRW-I designator indicates a 6 ft wide, red range dayboard with a white center stripe and a yellow, reflective strip along the bottom edge, which shows that it is used on the intracoastal waterway. The yellow strip is placed on the front dayboard only.

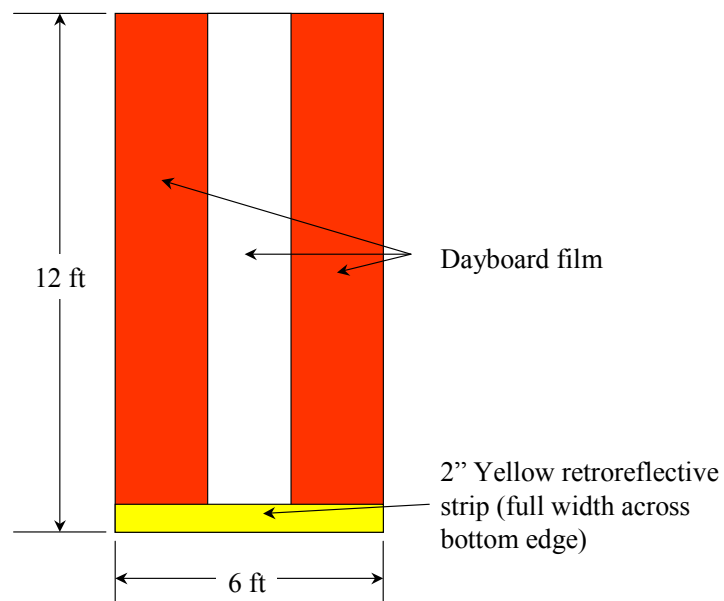


Figure 5-1. Sample 6KRW-I dayboard designator.

5.E.

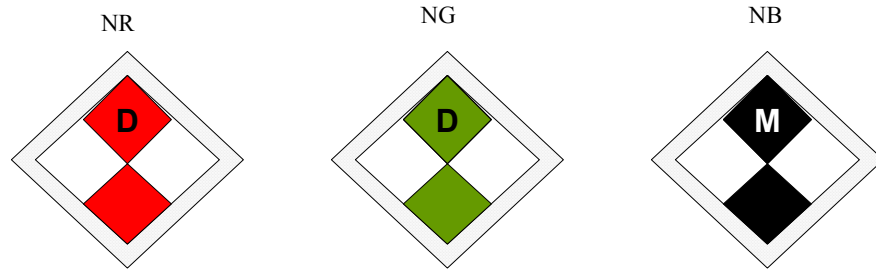


Figure 5-10b. Non-lateral marks
(except Western Rivers)

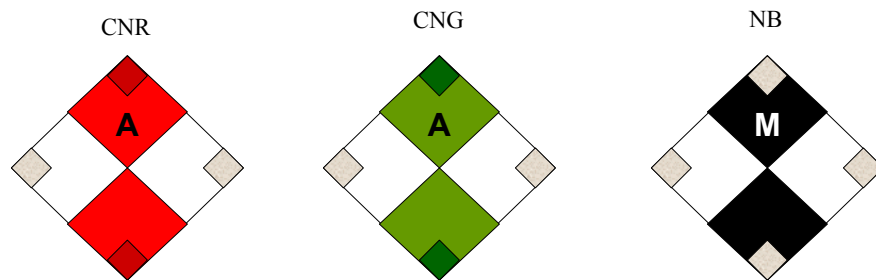


Figure 5-10c. Crossing marks (optional)
(Western Rivers)

Table 5-5

Dimensions for 1-, 2-, and 3-nm Nominal Range Dayboards
for all Waterways Special Marks

Mark	Nominal Range (nm)	H x W (in)	Retro* (R) (in)	Letter (L) (in)
3N_	1	36 x 36	2	8
4N_	2	48 x 48	3	12
6N_	3	72 x 72	4	16

*For Western Rivers, the square retroreflective patch should be 6" for the 3N_, 8" for the 4N_ and 12" for the 6N_.

Data Sheet 5-E(7), cont'd

5.E.

ALL WATERWAYS WARNING MARKS

System: All waterways.

Function: No lateral significance warning marks.

Nominal Range: 1nm (*as designated in Figure 5-11, below-use Table 5-5 for dimensions of warning marks with nominal ranges of 1-, 2- and 3-nm: except that the letter sizes for the word “DANGER” will be 6-in for a 3NW, 8-in for a 4NW and 10-in for a 6NW. Other wording will have 3-in letters on a 3NW, 4-in on a 4NW and 5-in on a 6NW).

Additional Data: The word “DANGER” will be centered on the daymark. Informational words may be placed above and/or below, as necessary (see examples below). Warning marks are used in the ICW without addition of the yellow strip.

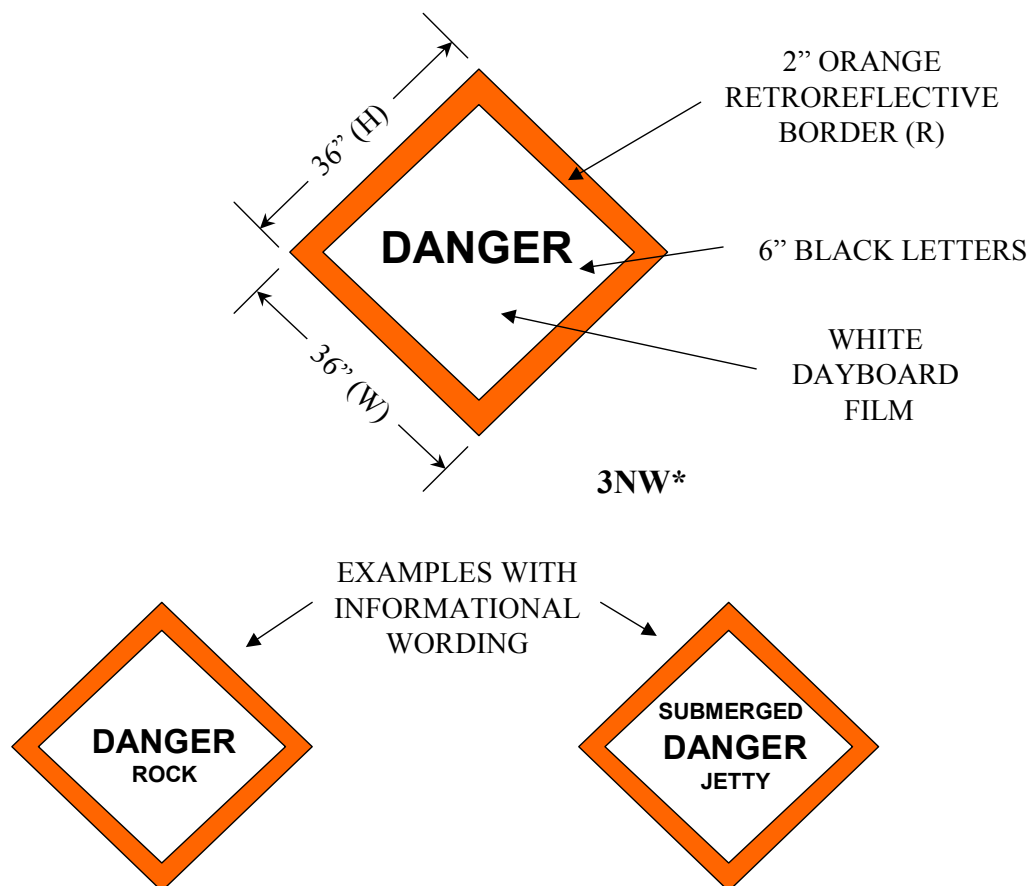


Figure 5-11. All waterways warning marks.

Data Sheet 5-E(8). All waterways warning marks (nominal ranges 1, 2 and 3 nm).

ALL WATERWAYS INFORMATION & REGULATORY MARKS

System: All waterways.

Function: No lateral significance information & regulatory marks.

Nominal Range: 1 nm (typical).

Additional Data: Information and regulatory marks do not have designators, as described in section B of this chapter. The border and center mark are orange retroreflective material. The remainder of the daymark is white dayboard film. Use black vinyl characters for informational wording, as necessary. Figure 5-12 illustrates the three types of information and regulatory marks, with typical wording. Information and regulatory marks are used in the ICW without addition of the yellow strip. Note—the warning mark, described in Data Sheet 5-E(8) is preferred to the "danger" version of the information and regulatory marks.

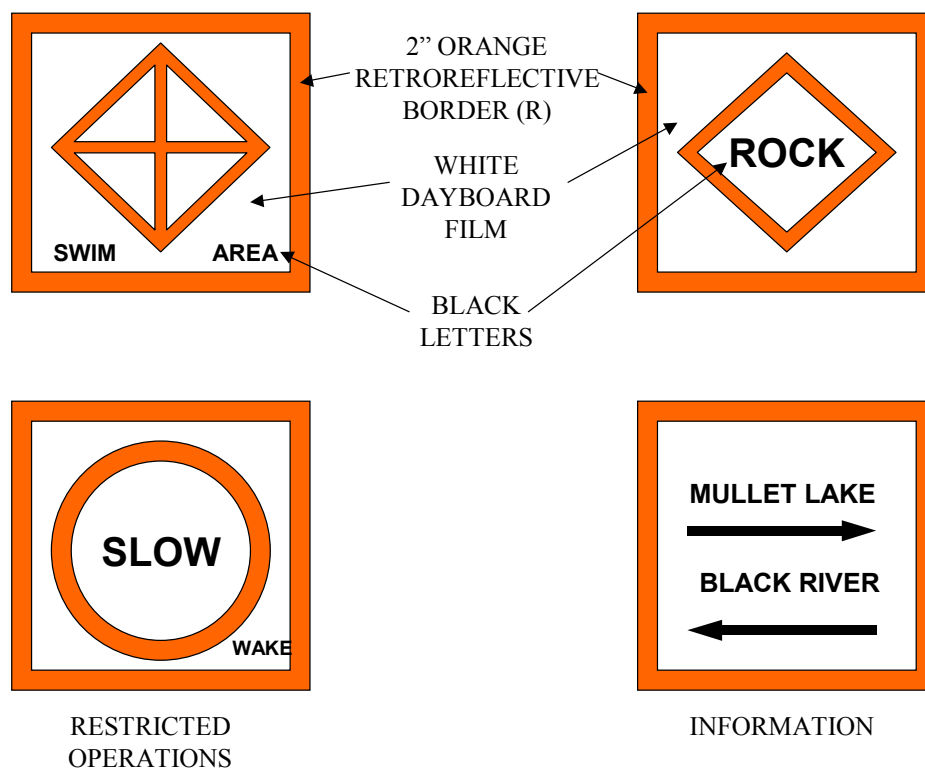


Figure 5-12. All waterways information & regulatory marks.

Data Sheet 5-E(9). All waterways information & regulatory marks

5.E.

ALL WATERWAYS SPECIAL MARKS

System: All waterways.

Function: No lateral significance special marks.

Nominal Range: 1 nm (*as designated in Figure 5-13, below—use Table 5-6 for dimensions of special marks with nominal ranges of 1-, 2-, and 3-nm).

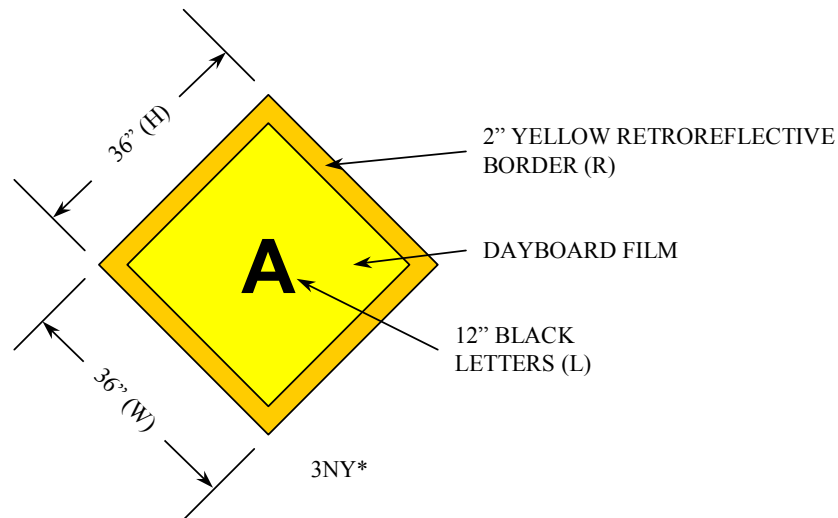


Figure 5-13. All waterways special mark.

Table 5-6

Dimensions for 1-, 2-, and 3-nm Nominal Range Dayboards
for All Waterways Special Marks

Mark	Nominal Range (nm)	H x W (in)	R (in)	L (in)
3NY	1	36 x 36	2	12
4NY	2	48 x 48	3	16
6NY	3	72 x 72	4	24

Data Sheet 5-E(10). General Use special marks (nominal ranges, 1, 2, and 3 nm).

- 6.B.3.b. (2) The Coast Guard has adopted a relatively small number of rhythms for general use. Rhythms that are produced by standard Coast Guard flashers are described in Table 6-1.

Table 6-1
Standard Coast Guard Rhythms

Classification	Rhythm	ON/OFF times (sec)	Duty Cycle %
Quick Flashing	Q	0.3/0.7	30
Flashing	Fl 2.5 (0.3)	0.3/2.2	12
Flashing	Fl 2.5 (1)*	1.0/2.5	40
Flashing	Fl 4 (0.4)	0.4/3.6	10
Flashing	Fl 4 (1.0)*	1.0/3.0	25
Flashing	Fl 6 (0.6)	0.6/5.4	10
Flashing	Fl 6 (1.0)*	1.0/5.0	17
Group Flashing	Fl (2 + 1) 6	0.3/0.4/0.3/1.2/0.3/3.5	15
Group Flashing	Fl (2) 5	0.4/0.6/0.4/3.6	16
Group Flashing	Fl (2) 6	1.0/1.0/1.0/3.0	33
Morse	Mo (A)	0.4/0.6/2.0/5.0	30
Isophase	Iso 2	1.0/1.0	50
Isophase	Iso 6	3.0/3.0	50
Occulting	Oc 4	3.0/1.0	75
Fixed	F	—	100

* Rhythms developed for 12-volt 100 and 110-watt lamps.

- (3) The AtoN Admin Manual prescribes the characteristics displayed by most minor aids. Characteristics for major aids are generally historical in nature, and were originally selected to assist the mariner in identification of the aid.
4. Equipment Selection. Following the criteria provided in the Visual Signal Design Manual, the Waterways Manager is usually afforded several options to meet the operational requirements of an AtoN light. These options may be limited, however, by other issues.
- a. Structure Limitations. One possible restriction on equipment selection is the structure on which it will be mounted. Only the 155mm and 200mm buoy lanterns may be installed on buoys or wooden single-pile structures located in the water. The 200mm buoy lantern is specifically designed for use where light-to-moderate icing is expected, and on exposed bars and jetties subject to breaking water. The 250mm and 300mm marine lanterns

- 6.B.4.a. (cont'd) are restricted to use on stable platforms. Rotating beacons should also be installed on structures that are not subjected to noticeable vibration. Some vibration may be damped by installation of Army-Navy rubber grommets between the mounting plate and the beacon base. The VRB-25 rotating beacon data sheet illustrates installation of vibration dampening grommets.
- b. Available Power. Another consideration in selecting lighting equipment is the availability of reliable commercial power. Commercial-power systems are generally simpler than those using solar power. In addition, although the 120-volt four-place lampchanger (CG-4P) holds fewer lamps than the 12-volt six-place lampchanger (CG-6P), the expected lamp life of the 120-volt, 150 watt and 250 watt lamps is 2000 hours, as opposed to 600 to 1000 hours for 12-volt marine signal lamps. Thus, use of commercial power and 120-volt lamps may allow for extending the service interval of an AtoN light (see Section D, below).
- c. Modernization and Characteristics. Replacement of a “classical” lens with a modern optic may lead to difficulty in matching the characteristic with the required luminous intensity. This difficulty is exacerbated for projects intended to solarize aids with large omnidirectional lanterns. Classical lenses do not provide an acceptable light signal when outfitted with 12-volt lamps, thus, conversion to solar power REQUIRES installation of modern, standard optics. The largest modern omnidirectional lantern that can be outfitted with 12-volt lamps, the 300mm marine lantern, can not provide a luminous intensity equal to that of even the smallest classical lens outfitted with 120-volt lamps; and rotating beacons can not replicate the characteristics generated by flashed, omnidirectional lanterns.

These limitations may necessitate a change to an historic characteristic, a reduction in the operational range, or both, when replacing an existing optic. Compromises of this nature should not be required for installation of a new aid to navigation. It is the responsibility of the Waterways Manager to balance the cost of an aid with the service provided. The use of standard hardware is the best means to achieving that balance.

5. Range Equipment Selection. A separate selection process is used for range lights. The *Range Design Manual*, COMDTINST M16500.4B, describes the *Range Design Program*, which provides minimum and recommended intensities for lights for a given range configuration. With this information, the Waterways Manager can identify the lens/lamp combinations that provide acceptable light signals. The light signals may be provided by omnidirectional lanterns or range lanterns. The benefit of an omnidirectional lantern is that the signal is visible while a vessel is off-axis, providing positional information to the mariner along a perpendicular approach to the channel axis. The greater intensity provided by range lanterns, however, is usually required for channel lengths longer than two miles.

C. Preparation and Installation.

1. Equipment Inspection. All AtoN lighting components should be inspected upon receipt. Electrical components, such as flashers, lampchangers, and rotating beacons, should be bench tested for 24 hours prior to being placed in service.
2. Servicing Guides & Manuals. The *Alternating Current Aids to Navigation Servicing Guide* (AC Servicing Guide), COMDTINST M16500.17 (series), and *Short Range Aids to Navigation Servicing Guide* (Short Range Servicing Guide), COMDTINST M16500.19 (series), provide specific installation instructions for 120-volt and 12-volt aids to navigation lighting components, respectively. In addition, major components, such as rotating beacons and range lanterns, are supplied with a manufacturer's installation and maintenance manual. Refer to these manuals prior to installation of a beacon or lantern and when performing preventive maintenance or troubleshooting.
3. Outfitting AtoN Lights. The various components, such as daylight controls, flashers, lampchangers, lamps, etc., that are used with an optic to make a complete AtoN light, are identified in the various lantern and beacon data sheets found in Section E of this chapter and in the Servicing Guides. Refer to the appropriate data sheet and the Servicing Guides for proper assembly of the light.
4. Wiring—12-volt DC. Requirements for wiring 12-volt solar powered aids are discussed in the Solar Design Manual. The information found herein provides general information on selection of appropriate wiring for AtoN lights. More detailed information will be found in the *Solar Design Manual*, COMDTINST M16500.24 (series), and the applicable Standard Configuration Drawings, available from the Civil Engineering Units.
 - a. Conventions. Wires used for power leads and for internal wiring are color-coded. Power leads shall use BLACK as "Positive (+)" (12VDC) and WHITE as "Negative (-)" (0VDC). Internal wiring of an optical assembly uses RED for the lamp circuit (L), BLUE for the lampchanger turret-advance pulse (F), and YELLOW for the daylight control circuit (S). The negative lead shall use WHITE.
 - b. Wire Type. Minor aids are typically wired with two-conductor, SO-type cable. The use of SO, SEO, and similar wire is discouraged for installation at major aids, such as solar powered lighthouses and ranges, as their long term resistance to sunlight is poor. Individual insulated conductors, suitable for outdoor installation, should be installed in rigid plastic or steel conduit, or "Liquid-flex" flexible metal conduit. Leads for the VRB-25 rotating beacon shall be installed in grounded, metallic conduit only.

- 6.C.4. c. Termination. Wires terminated under pressure or clamp type terminals do not require lugs, however, use of No-ox grease is recommended to prevent corrosion. Screw terminals require ring or locking spade lugs. Soldering the lugs to the wire, in addition to crimping with heavy-duty industrial crimpers, is recommended. Soldering will prevent crevice corrosion and eventual failure of the connection. If connections are not soldered, a visual inspection of all joints is required during scheduled service visits.
- d. Acceptable Voltage Drop. Wire size is based on the acceptable voltage drop of the circuit. The maximum acceptable voltage drop is 0.75 volts for the “charging system,” the wire run from the solar panels (or battery charger) to the battery. For minor aids, the maximum allowable voltage drop due to the wiring from the battery to the load(s) (the “power leads”) is 0.10 volts. For major aids, the maximum allowable voltage drop for power leads is 0.35 volts. Table 6-2 provides conservative values for the maximum length of power cable for 12-volt installations.

Table 6-2
Maximum Length—12-volt Power Leads

Lamp Rating	Maximum Length of Power Leads (ft)				
	Major Aids				Minor
	12AWG	10AWG	8AWG	6AWG	12AWG
0.25A	350	560	900	1400	125
0.55A	160	260	410	650	55
0.77A	115	180	290	460	40
1.15A, & 1.0A	75	120	195	310	27
2.03A, & 1.9A	45	70	110	175	15
3.05A, 3.0A, & 35W	30	45	75	115	10
50W	20	35	55	85	—
75W	15	25	35	55	—
100W & 110W	10	15	25	40	—

- e. 12VDC Wiring Details. Details on the wiring of internal components to an AtoN light are described in the Short Range Servicing Guide, and in the various data sheets found in Section E of this chapter.
- f. Obstructions. Vertical obstructions in front of omnidirectional lanterns should be avoided. Contact Commandant (G-SEC-2A) for assistance in determining the reduction in service when obstructions are placed in front of any lantern.

6.C. 9. Lantern Requirements. When used by itself, the word *lantern* shall be understood to mean the structure at the top of a lighthouse that surrounds and protects the optic.

- a. Ventilation. Lanterns must have adequate rain-proof vents to equalize the inside and outside temperatures. Failure to maintain working vents may result in condensation on the lantern panes, severely reducing the light intensity. This requirement is especially true in lighthouses with 12-volt signals, which do not emit enough excess heat to evaporate condensation that may form.
- b. Prevention of False Flashes. False flashes occur when a beam from a rotating beacon is reflected off a lantern pane, and is emitted out the far side of the lantern. It is especially prevalent in lighthouses outfitted with the DCB24 rotating beacon, or when the DCB224 or VRB-25 rotating beacons are used to produce group rhythms. Where practicable, lantern panes should be installed with the top edge slanted out $\frac{5}{8}$ " per foot of height beyond the bottom edge (approximately 3 degrees from vertical). For lanterns that cannot readily be modified, retractable shades may be hung in the lantern. The shades shall extend radial from the optic to the astragals supporting the lantern panes.
- c. Control of Ambiguous Color Sectors. Producing colored sectors by use of colored lantern panes will result in an ambiguous zone between white and colored sectors. The angular size of the zone is proportional to the ratio of the emitting surface of the light to the distance between the emitting surface and the color filter. In general, colored sectors should not be installed at aids with rotating beacons due to the relatively large ambiguity zone created. Prior to replacing an omnidirectional lantern with a rotating beacon at aids with colored sectors, the impact of an enlarged ambiguity zone must be evaluated. Existing colored sectors at aids with rotating beacons may be retained.

If a DCB224 rotating beacon is used at an aid with colored sectors, the two beams shall be separated by 180 degrees and point radial outward from the axis of rotation, or the two beams shall be separated by 90 degrees.

- d. Colored Lantern Panes. UV stabilized, transparent lexan or plexiglass (acrylic) may be used to replace colored glass lantern panes. Plexiglass color numbers (Rohn & Haas Company) that are suitable for use are 2124 (green), 2226 (red), and 2129 (red). Use off-the-shelf transparent cast sheets. Sheeting should be rated by the manufacturer to have 20 to 30 percent transmission of incandescent light. Due to the difficulty in obtaining red lantern panes, Commandant (G-SEC) has stocked 4 by 8 foot

- 6.C.9.d. (cont'd) sheets of red cast acrylic in the supply fund at the Engineering Logistics Center. Sheets may be obtained by MILSTRIP using stock number 9330-01-429-6103.

D. Inspection, Maintenance and Repair on Station.

1. Inspection and Maintenance Schedule. The inspection and maintenance schedule for AtoN light signals will vary from semi-annual to triennial, depending on the equipment in service. Service intervals for lighthouse equipment are established in the *Major Aids to Navigation Preventive Maintenance System Guide* (PMS Guide), COMDTINST M16500.10 (series). A copy of the PMS Guide, tailored to the equipment at a given aid, shall be maintained by the primary servicing unit for every aid that falls under the manual's guidelines. The AtoN Admin Manual establishes a maximum service interval of three years for some minor aids. The limiting item to allowing a three-year service interval for minor aids is often lamplife.
 - a.. Lighthouses. Follow the guidelines prescribed for the installed equipment, as set forth in the PMS Manual.
 - b. Fixed and Floating Unlighted Aids. The servicing interval for an unlighted aid shall not exceed five years. The Aids to Navigation Servicing Interval Flowchart (AtoN SIF), used to determine the allowable servicing interval of existing aids, is provided in Chapter 7 of the AtoN Admin Manual.
 - c. Fixed and Floating 12-volt DC Lighted Aids (except ranges). The servicing interval shall not exceed three years, or the "Maximum Allowable Service Interval Due to Lamplife" shown in Table 6-2A. The Aids to Navigation Servicing Interval Flowchart (AtoN SIF), used to determine the allowable servicing interval of existing aids, is provided in Chapter 7 of the AtoN Admin Manual.
 - d. Fixed 120-volt AC Lighted Aids (except ranges). The servicing interval for 250mm and 300mm lanterns with 250-watt lamps shall not exceed three years, or the "Maximum Allowable Service Interval Due to Lamplife" shown in Table 6-2A. FA-251-AC lanterns with 150-watt lamps shall be serviced annually because of lamplife. The servicing interval for aids with 1000-watt lamps shall not exceed two years, or the "Maximum Allowable Service Interval Due to Lamplife" shown in Table 6-2A.
 - e. Ranges. The service interval shall not exceed two years, or the "Maximum Allowable Service Interval Due to Lamplife" shown in Table 6-2A. For day/night ranges with different day/night lights, the maximum allowable service interval for both the daytime and the nighttime optics

6.D.1.e. (cont'd) must be computed separately. Use the lesser of the two solutions to establish the service interval of all the optics for the range. For day/night ranges with the same optic burning day and night, the Maximum Allowable Service Interval Due to Lamplife should be ½ of the value shown in Table 6-2A.

f. Arduous Conditions. Under arduous environmental conditions the actual lamplife may be less than that shown in Table 6-2A. Experience may dictate a shorter Service Interval than that shown in Table 6-2A.

Table 6-2A: Maximum Allowable Service Interval Due to Lamplife (years + months)

Flash Characteristic	C-8 and CC-8 Tungsten Filament Lamps in 6-place Lampchanger (Note 1)	C-8 Tungsten-Halogen Filament Lamps in 6-place Lampchanger (except 110W lamp) (Note 2)	110W C-8 Tungsten-Halogen Lamps in 6-place Lampchanger	150W & 250W 120VAC Lamps in 4-place Lampchanger	1000W 120VAC Lamps in 2-place Lampchanger
Fl 4, Fl 6	11 yrs + 8 mo	23 yrs + 4 mo	N/A	14 yrs + 12 mo	N/A
Fl 2.5	9 yrs + 9 mo	19 yrs + 5 mo	N/A	12 yrs + 6 mo	N/A
Fl (2+1) 6	7 yrs + 9 mo	15 yrs + 7 mo	N/A	9 yrs + 12 mo	N/A
Fl (2) 5	7 yrs + 4 mo	14 yrs + 7 mo	N/A	9 yrs + 4 mo	N/A
Q, Mo(A)	3 yrs + 11 mo	7 yrs + 9 mo	N/A	4 yrs + 12 mo	N/A
Fl (2) 6	3 yrs + 6 mo	7 yrs + 1 mo	2 yrs + 1 mo	4 yrs + 6 mo	N/A
Fl 2.5 (1)	2 yrs + 11 mo	5 yrs + 10 mo	1 yr + 9 mo	3 yrs + 9 mo	2 yrs + 7 mo
Iso 2, Iso 6	2 yrs + 4 mo	4 yrs + 8 mo	1 yr + 5 mo	3 yrs + 0 mo	2 yrs + 1 mo
Occ 4	1 yr + 7 mo	3 yrs + 1 mo	0 yrs + 11 mo	2 yr + 0 mo	1 yr + 4 mo
Fixed	1 yr + 2 mo	2 yrs + 4 mo	0 yrs + 8 mo	1 yr + 6 mo	1 yr + 0 mo

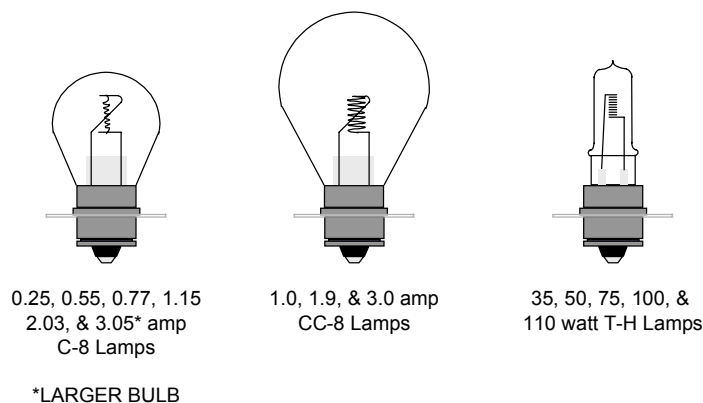
Note 1. Includes 0.25, 0.55, 0.77, 1.15, 2.03 & 3.05 amp C-8 lamps and 1.0, 1.9 & 3.0 amp CC-8 lamps.

Note 2. Includes 35, 50, 75 & 100 watt C-8 lamps.

2. Maintenance and Repair Guidelines. Detailed information on the maintenance and repair of standard equipment is provided in the Servicing Guides and in the manufacturers' manuals. Questions concerning specific maintenance requirements may be directed to the supporting Group Office, the District Aids-to-Navigation Office, National AtoN School staff, or COMMANDANT (G-SEC).

E. General Description Data Sheets.

12-Volt Marine Signal Lamps



Function. 12-volt marine signal lamps are used with a variety of omnidirectional lanterns, as well as the RL14 range lantern and the VRB-25 rotating beacon. There are three types of 12-volt marine signal lamps: tungsten lamps with C-8 filaments (vertical coil); tungsten lamps with CC-8 filaments (vertical coiled-coil); and tungsten-halogen lamps with C-8 filaments. The C-8 tungsten filament lamps are normally used in omnidirectional lanterns at both fixed and floating aids, to provide a light with a nominal range of less than 9nm. **If an RL14 range lantern is outfitted with these lamps, a spread lens must also be installed.** The CC-8 tungsten filament lamps are primarily used in the RL14 range lanterns; use of these lamps does not require a spread lens. Tungsten-halogen lamps may be used in the RL14 range lantern (spread lenses are not required) and in the VRB-25 rotating beacon. Due to the relative shortness of their filaments, the CC-8 tungsten filament lamps and tungsten-halogen lamps (except the 100 and 110 watt lamps) are not authorized for use in omnidirectional lanterns.

Features.

- Omnidirectional light output in the horizontal plane.
- C-8 or CC-8 incandescent filament (vertical orientation).
- Minimum 500-hr life expectancy when burned fixed.
- Prefocus collar, for accurate alignment of lamp in lampchanger.
- Nickel-plated brass, single-contact base.

Related Equipment. The lamps are used with a CG-6P lampchanger and either a CG-181/493 flasher or a SAC-II. The 155 and 200mm omnidirectional lanterns may only be equipped with C-8 tungsten filament lamps, up to and including the 2.03 amp lamp. The 250 and 300mm lanterns may only be equipped with C-8 tungsten filament lamps or the 100 or 110watt tungsten-halogen lamps. The RL14 range lantern may be equipped with C-8 tungsten filament lamps (with spread lens), CC-8 tungsten filament lamps (with or without spread lenses), and with C-8 tungsten-halogen lamps (with or without spread lenses). The VRB-25 rotating beacon may be equipped with any 12-volt lamp, however optimum performance is achieved with tungsten-halogen lamps.

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Additional Data. Technical specifications for 12-volt lamps are given in specification number G-ECV-487. The general configuration and dimensions of 12-volt marine signal lamps and the prefocus collar are illustrated in figure 6-1. Lamps are stocked at Engineering Logistics Center, Baltimore. Table 6-3 describes the operational data for the lamps, and provides stock numbers for ordering through the national stock system. Marine signal lamps are sold in boxes of ten.

Table 6-3A: C-8 Tungsten Filament Lamps

Lamp Rating (Amps)	Lamp Life (Hours)	Output (Lumens)	Minimum On Time (Seconds)	Bulb Type	National Stock Number
0.25	1000	30	0.30	S-8	6240-01-032-5034
0.55	1000	70	0.30	S-8	6240-01-199-2374
0.77	1000	120	0.30	S-8	6240-01-186-2033
1.15	1000	180	0.30	S-8	6240-01-186-2032
2.03	1000	380	0.30	S-8	6240-00-262-8845
3.05	1000	600	0.40	S-11	6240-00-262-8840

Table 6-3B: CC-8 Tungsten Filament Lamps

Lamp Rating (Amps)	Lamp Life (Hours)	Output (Lumens)	Minimum On Time (Seconds)	Bulb Type	Activity Control Number
1.0	1000	145	0.30	S-11	6240-01-420-4236
1.9	1000	390	0.30	S-11	6240-01-420-4240
3.0	1000	600	0.40	S-11	6240-01-420-4246

Note: Recommended for use in the RL14 range lantern.

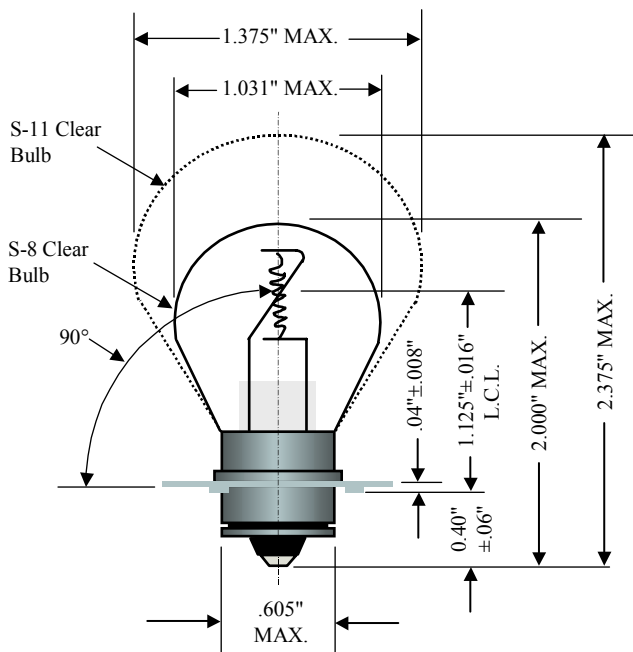
Table 6-3C: C-8 Tungsten-Halogen Lamps

Lamp Rating (Watts)	Lamp Life (Hours)	Output (Lumens)	Minimum On Time (Seconds)	Bulb Type	National Stock Number
35	2000	630	0.40	T-4	6240-01-487-7863
50	2000	1000	0.50	T-4	6240-01-487-7880
75	2000	1600	0.60	T-4	6240-01-487-7892
100	2000	2400	1.00	T-4	6240-01-487-7898
110	600	2600	1.00	T-4	6240-01-374-5113

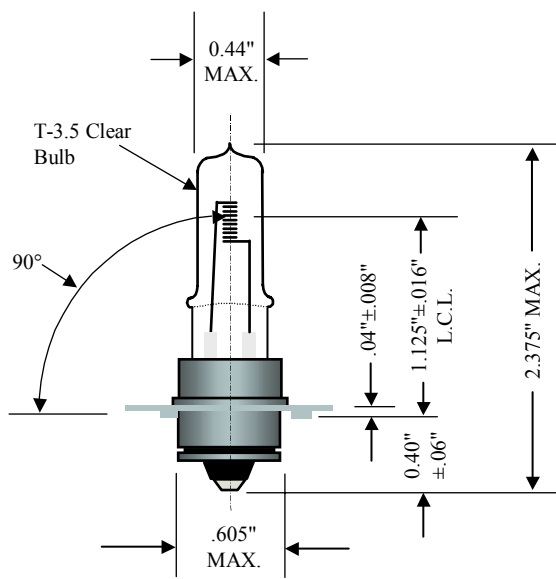
Note: Recommended for use in the RL14 range lantern and VRB-25 rotating beacon.

Data Sheet 6-E(1). (cont'd).

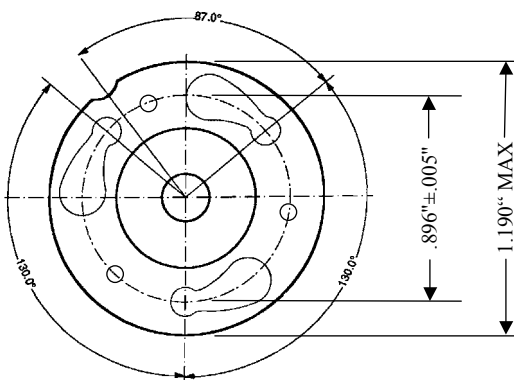
6.E.



S-8 and S-11 Bulbs
(Tungsten Filament)



T-3.5 Bulbs (Tungsten-Halogen)



Single-Contact Candelabra Base with Prefocus Collar

Figure 6-1. Dimensions of 12-volt lamps and base.

Data Sheet 6-E(1). (cont'd).

6-E.

Table 6-5
Standard Flash Rhythms

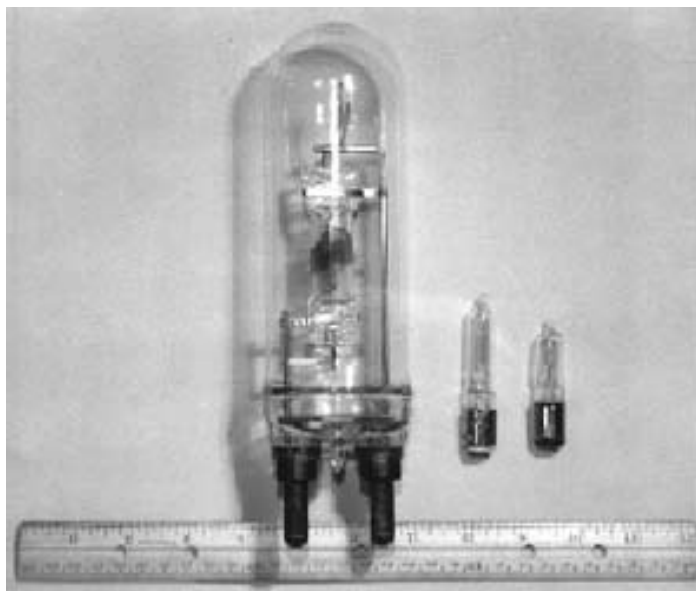
Code	Type	National Stock Number	Timing Sequence (on/off) in sec.	Duty Cycle
FL6(0.6)	CG-181*	5945-00-101-9643	0.6 / 5.4	0.10
FL6(1)	CG-481	5945-01-GL3-5359	1.0 / 5.0	0.17
FL4(0.4)	CG-181*	5945-00-007-7942	0.4 / 3.6	0.10
FL4(1)	CG-481	5945-01-GL3-5358	1.0 / 3.0	0.25
FL2.5(0.3)	CG-181*	5945-00-007-7941	0.3 / 2.2	0.12
FL2.5(1)	CG-181*	5945-01-GL3-6031	1.0 / 1.5	0.40
	CG-481	5945-01-GL3-5357		
Q	CG-181*	5945-00-101-9641	0.3 / 0.7	0.30
FL(2) 5	CG-181*	5945-00-007-7946	0.4 / 0.6 / 0.4 / 3.6	0.16
FL(2) 6	CG-181*	5945-00-101-9434	1.0 / 1.0 / 1.0 / 3.0	0.33
FL(2+1) 6	CG-181*	5945-01-141-8159	0.3 / 0.4 / 0.3 / 1.2 / 0.3 / 3.5	0.15
Mo(A)	CG-181*	5945-00-101-9396	0.4 / 0.6 / 2.0 / 5.0	0.30
ISO 2	CG-181*	5945-01-GL3-6064	1.0 / 1.0	0.50
	CG-481	5895-01-GL7-6171		
ISO 6	CG-181*	5945-00-007-7943	3.0 / 3.0	0.50
	CG-481	5945-01-GL3-5356		
OC 4	CG-181*	5945-00-007-7944	3.0 / 1.0	0.75
	CG-481	5945-01-GL3-5355		
Fixed	CG-181*	5945-00-007-7945	Continuous	1.00
	CG-481	5945-01-GL3-5354		
Programmable	CG-493	5945-00-460-3349	Programmable	Programmable

* Fixed rhythms are no longer being purchased and will be replaced by programmable flashers as supplies are exhausted.

Data Sheet 6-E(6). (cont'd).

6.E.

120-Volt Lamps



Function. The 120-volt lamps are used when a light with a nominal range greater than 9 nm is required and commercial power is available. These lamps can be used in fixed and rotating lanterns to generate pencil beams and omnidirectional fan beams.

Features.

- Omnidirectional light output in the horizontal plane.
- Incandescent filament.
- Tungsten-Halogen for long life expectancy and high lumen maintenance.
- Quartz bulbs.
- Large filaments for easy focusing and large vertical divergences.

Related Equipment.

- The 1000W lamp is used in the 24-inch optics, including the DCB24, DCB224, and RL24. It may also be used in classical lenses.
- The 250W lamp is used in the 250mm and 300mm signal lanterns, and may also be used in the RL14 range lantern and smaller classical lenses.
- The 150W lamp is used in the FA-251-AC rotating beacon and the RL14 range lantern.
- The Carlisle & Finch Company manufactures a two-place, horizontal-swing lampchanger (CG-2P) for use with the 1000W lamp.
- Tideland Signal Corporation manufactures a four-place lampchanger (CG-4P) for use with both the 250W and 150W lamps.
- The FLAC-300 (Data Sheet 6-E(12)), the AC flash controller and the Audio-Visual Controller, described in Chapter 8, are used to flash 120-volt lamps.

Data Sheet 6-E(7). 120-Volt Lamps.

6.E.

Performance Characteristics.

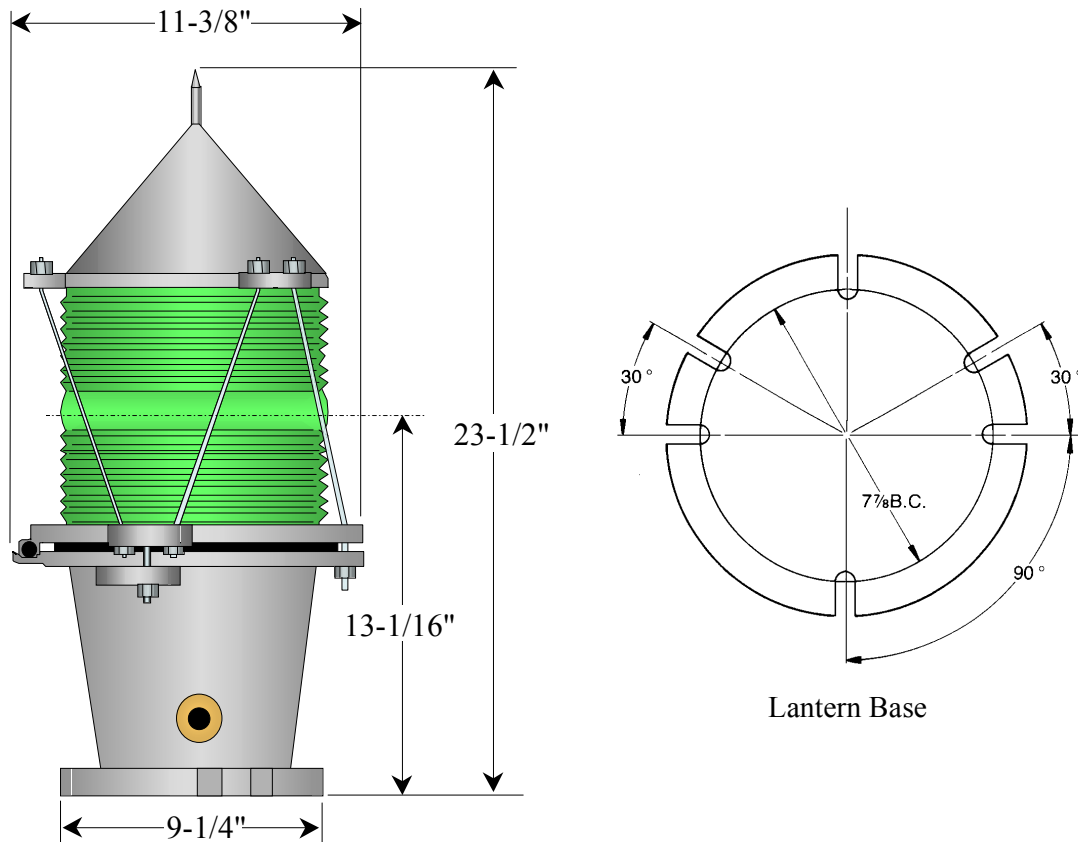
Table 6-8
200mm Buoy Lantern Performance with 12-volt Lamps
NOMINAL RANGES (NMI) – 200 MM LANTERN (GLASS LENS)

LENS	LAMP 12V	FL 2.5(0.3) FL (2+1) 6 Q	FL 4(0.4) FL (2) 5 Mo (A)	FL 6(0.6)	FL (2) 6 FL 2.5(1) ISO 2	ISO 6 OCC 4	FIX	
CLEAR	0.25A	3	3	3	4	4	4	
	0.55A	4	4	5	5	5	5	
	0.77A	5	5	5	5	6	6	
	1.15A	5	5	6	6	6	6	
	2.03A	6	6	7	7	7	8	
	3.05A		7	7	8	8	8	
YELLOW	0.25A	2	2	3	3	3	3	
	0.55A	3	3	4	4	4	4	
	0.77A	4	4	4	4	4	5	
	1.15A	4	4	5	5	5	5	
	2.03A	5	5	6	6	6	6	
	3.05A		5	6	6	7	7	
RED	0.25A	2	2	2	2	2	2	
	0.55A	2	2	3	3	3	3	
	0.77A	3	3	3	3	3	4	
	1.15A	3	4	4	4	4	4	
	2.03A	4	4	4	5	5	5	
	3.05A		4	5	5	5	5	
GREEN	0.25A	2	2	2	2	2	2	
	0.55A	2	2	3	3	3	3	
	0.77A	3	3	3	3	3	4	
	1.15A	3	4	4	4	4	4	
	2.03A	4	4	4	5	5	5	
	3.05A		4	5	5	5	5	
LAMP CURRENT RATING (AMP)			0.25	0.55	0.77	1.15	2.03	3.05
VERTICAL DIVERGENCE (DEG)								
50% BEAM WIDTH			<u>+1.7</u>	<u>+2.1</u>	<u>+2.6</u>	<u>+2.6</u>	<u>+2.5</u>	<u>+2.5</u>
15% BEAM WIDTH			<u>+2.2</u>	<u>+3.7</u>	<u>+3.7</u>	<u>+3.9</u>	<u>+3.8</u>	<u>+2.5</u>
NOTE: Consult the Visual Signal Design Manual for intensities.								

Data Sheet 6-E(14). (cont'd).

6.E.

Dimensions. The dimensions of the 200mm buoy lantern are illustrated in figure 6-24. The older version of the lantern is slightly shorter, and has a base with four equally spaced mounting slots, rather than six slots for either 3 or 4 point mounting. In either case, use only three bolts to mount the lantern. The overall weight of the 200mm buoy lantern is 30 lbs. (13.5 kg).



Data Sheet 6-E(14). (cont'd).

6.E.

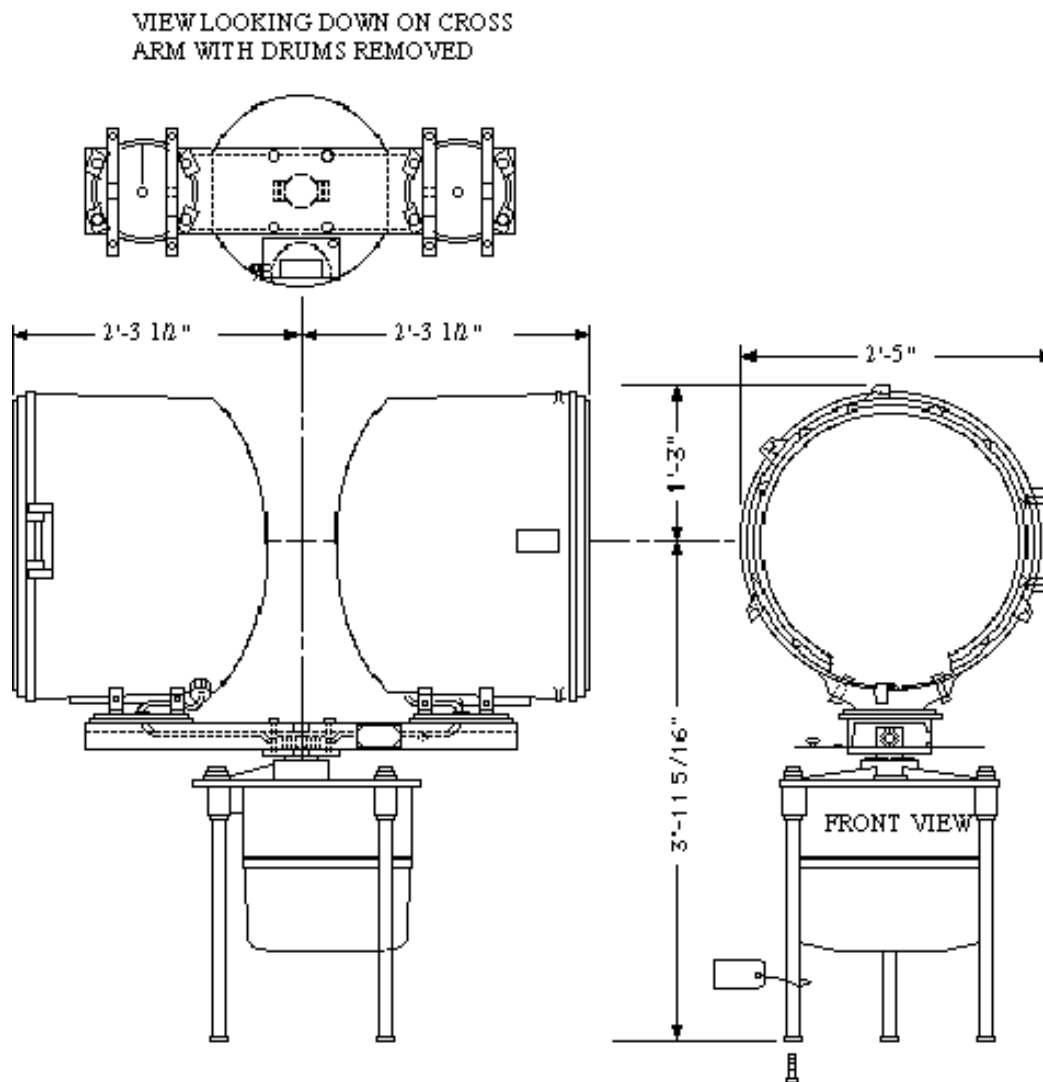


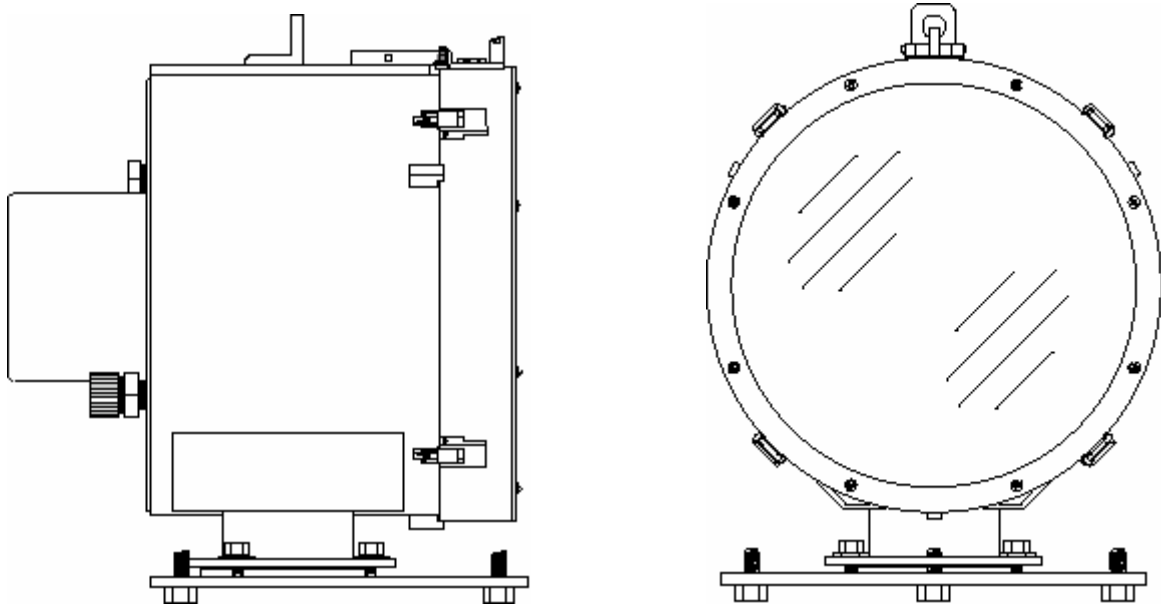
Figure 6-51. Dimensions of the DCB224 Rotating Beacon.

Additional Data. The DCB24 rotating beacon and DCB224 rotating beacon are stocked at Engineering Logistics Center, Baltimore, in Project 98A. Requests for DCB24 and DCB224 beacons should be addressed to Commandant (G-SEC-2A). The manufacturer of the beacons is The Carlisle and Finch Co., (513) 681-6080. The Crouse-Hinds version of the 24-inch beacons are not authorized for new installations, and should be replaced when no longer serviceable.

Data Sheet 6-E(19). (cont'd).

6.E.

RL14 Range Lantern



Function. The RL14 range lantern emits a high intensity pencil beam for use as a range light, and may be outfitted with either standard 12-volt or 120-volt lighting hardware. The RL14 range lantern must be installed on a stable platform.

Features.

- Anodized aluminum housing.
- Watertight seals.
- Requires precision leveling.
- Prefocused for standard 12-volt and 120-volt lamps.
- Replaceable clear, green, and red transparent cover glasses.
- Several spread lenses available (clear, green, and red).

Related Equipment. The RL14 range lantern may be outfitted with standard 12-volt or 120-volt AtoN hardware. For 12-volt applications the lantern is outfitted with a CG-6P/CG-6PHW lampchanger and CG-181/CG-481 flasher. For 120-volt applications, the lantern may be outfitted with a CG-4P lampchanger (with or without a Type K daylight control) for fixed-on signals, or with a CG-4P lampchanger and FLAC-300 flasher, for flashing signals. A Type L daylight control is used for 12-volt applications, and when an FLAC-300 is installed. Tables 6-17 through 6-19, which provide the performance characteristics of the lantern, also provide the permissible combinations of lantern, lamp, and spread lenses. Fields showing “N/A” mean that the equipment combination is not authorized.

Data Sheet 6-E(20). RL14 Range Lantern.

6.E.

Cover Glasses. New lanterns are provided with a clear cover glass. A cover glass is also called a flat lens or a 0° spread lens. A cover glass is a flat piece of glass that has no lensing power. Colored cover glasses are available as commercial items from Tideland Signal Corp. (713) 681-6101. **An RL14 range lantern with a cover glass cannot be used with any C-8 marine signal lamp** (including 0.25, 0.55, 0.77, 1.15, 2.03 and 3.05 amp lamps). Using a C-8 marine signal lamp in an RL14 lantern with a cover glass is not, and has never been authorized due to “beam wander.”

Used with an *authorized* 12V lamp (a CC-8 or tungsten-halogen lamp), an RL14 with a cover glass has a beam width of about 1° (full width to half the maximum intensity). Used with 120VAC lamps, the full beam widths for an RL14 with a cover glass are 1.2° and 2° for 150W and 250W lamps respectively.

Spread Lenses. An RL14 Range Lantern can be equipped with a spread lens to increase the width of the beam. Spread lenses come in 5 sizes: 3°, 8°, 11°, 20° and 28°. The value specifies the full beam width (to half maximum intensity). Spread lenses are clear, green or red. A spread lens replaces the cover glass that is provided with a new lantern. Spread lenses are available as commercial items from Tideland Signal Corp. (713) 681-6101. Further information on installing a spread lens in an RL14 range lantern can be found in the Short Range Aids to Navigation Servicing Guide, COMDTINST M16500.19 (series).

Additional Data. There are two versions of the RL14 range lantern that have been installed in the field, one manufactured by Tideland Signal Corp., the second manufactured by The Carlisle and Finch Company. The Tideland Signal Corp. version uses a glass mirror, and was designate the RL355 lantern. It is not authorized for new installations. The Carlisle and Finch Company version has a metal mirror, and machined stops on the bezel assembly and drum, to insure optimum alignment of the optical system whenever the lantern is opened and closed. The RL14 range lantern is stocked at Engineering Logistics Center, Baltimore in Commodity 5 (Supply Fund), with NSN 6210-01-GL3-4426.

Data Sheet 6-E(20). (cont'd).

6.E.

Dimensions. The overall dimensions of the RL14 range lantern are illustrated in figure 6-58. The RL14 range lantern weighs approximately 36 lbs. (16 kg).

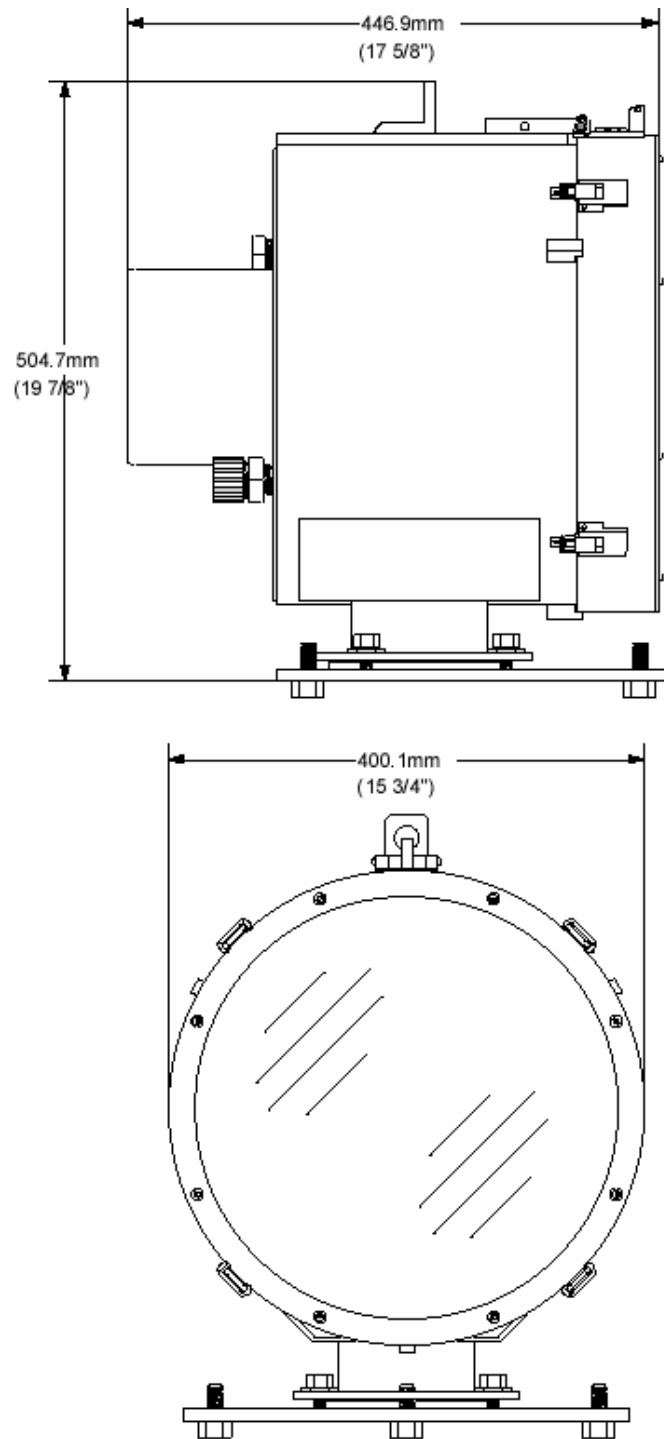


Figure 6-58. Dimensions of the RL14 Range Lantern.

Data Sheet 6-E(20). (cont'd).

6.E.

Wiring & Component Installation—12-Volt. The power cable used for 12-volt operation shall be 12/2 SO cable. (Note: a Low-Voltage Drop Kit (see Chapter 9) may be used to allow for installation of heavier gauge cable between the battery room and on the lantern deck in an effort to reduce voltage drop over the power run.) The procedures listed below are for stand-alone range lanterns that are daylight controlled. Eliminating the daylight control will result in a 24-hour per day range light signal. Day/night ranges are controlled by a Range Switch Box-DC (see Chapter 9). The wiring schematic for a 12VDC day/night range system is illustrated in Ocean Engineering Drawing 140503.

- (1) Open the range lantern door, and lock the door in the open position.
- (2) Insert the power cable through the cable gland. Terminate the leads with spring spade lugs sized for a #8 stud. Do not tighten the cable gland.
- (3) Remove the pipe plug from the $\frac{3}{4}$ " NPT threaded hole. Insert the photoresistor leads for a Type L daylight control through the hole. Screw the daylight control into the threaded hole and tighten gently with a wrench.
- (4) Locate the "DC Installation Kit," which came with the RL14 range lantern. Using the color-coded wires from the kit, wire a six-place lampchanger and flasher together, as discussed in Data Sheet 6-E(6). The lampchanger bracket should be oriented so that the label "CG6P" is up (see figure 6-52). Use a CG-6PHW lampchanger and CG-481 flasher if the lantern is to be outfitted with tungsten-halogen lamps rated above 35 watts.
- (5) Rotate the spacer blocks located at the back of the lantern drum so that the lampchanger bracket will rest over the spaces marked for the CG-6P. Gently tighten the mounting screw for each spacer block.
- (6) Wire the power cable and Type L daylight control to the flasher.
- (7) Mount the lampchanger/flasher assembly on the spacer blocks using the screws, flat washers, and lock washers provided.
- (8) Tighten the cable gland, and dress any loose wires.
- (9) Close the range lantern door and carefully latch all the latches.

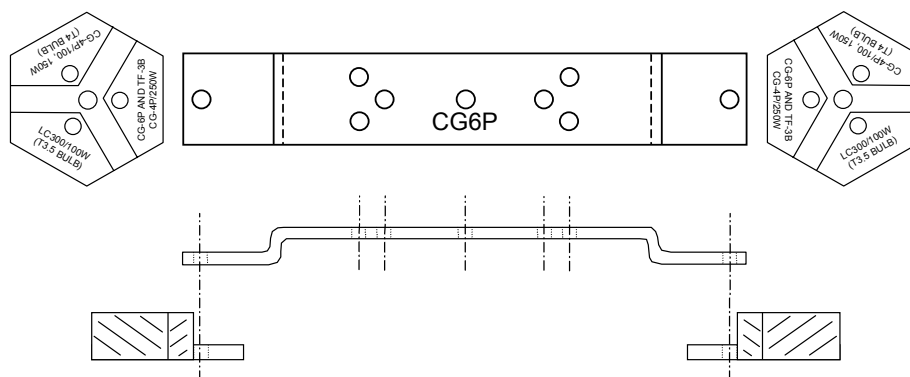


Figure 6-52. Lampchanger Bracket and Spacer Orientation for 12-volt Installation.

Data Sheet 6-E(20). (cont'd).

6.E.

Wiring & Component Installation—120-Volt. The power cable used for 120-volt operation shall be 12/3 SO cable. The procedures listed below are for stand-alone range lanterns that are daylight controlled. Eliminating the daylight control will result in a 24-hour per day range light signal. Day/night ranges are controlled by a Range Switch Box-AC (see Chapter 9). The wiring schematic for a 120VAC day/night range is illustrated in Ocean Engineering Drawing 130503.

a. Fixed-on:

- (1) Open the range lantern door, and lock the door in the open position.
- (2) Insert the power cable through the cable gland. **INSURE THAT POWER IS SECURED.** Terminate the leads with spring spade lugs sized for a #8 stud. Wire the cable to the terminal block on the back wall of the lantern, and tighten the cable gland.
- (3) Remove the pipe plug from the $\frac{3}{4}$ " NPT threaded hole. Install a $\frac{3}{4}$ " to $\frac{1}{2}$ " reducer pipe bushing in the threaded hole. Insert the leads, and screw a Type K daylight control into the threaded hole. Tighten gently with a wrench.
- (4) Using the "AC Installation Kit" that came with the lantern, attach the color-coded wires to a CG-4P lampchanger. If a daylight control is used, remove the jumper between the red and black terminals of the CG-4P.
- (5) Mount the CG-4P to the lampchanger bracket, with the bracket oriented so that the label "CG4P" is up.
- (6) Wire the Type K daylight control to the CG-4P.
- (7) Rotate the spacer blocks located at the back of the lantern drum so the lampchanger bracket will rest over the spaces marked for the CG-4P AND for the selected lamp (150 or 250 watt), as illustrated in figure 6-53 and figure 6-54.
- (8) Mount the lampchanger assembly on the spacer blocks using the screws, flat washers, and lock washers provided.
- (9) Wire the AC installation kit leads that are installed on the CG-4P to the terminal block.
- (10) Dress any loose wires.
- (11) Close the range lantern door and carefully latch all the latches.
- (12) Turn 120-volt power on.

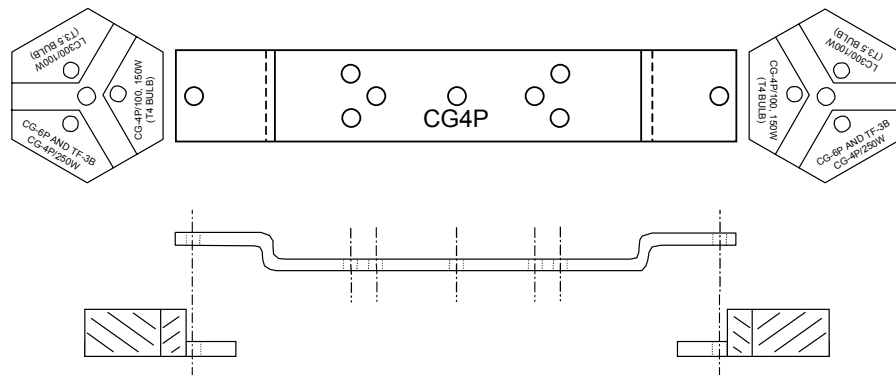


Figure 6-53. Lampchanger Bracket and Spacer Orientation for 120-volt, 150 watt Installation.

Data Sheet 6-E(20). (cont'd).

6.E.

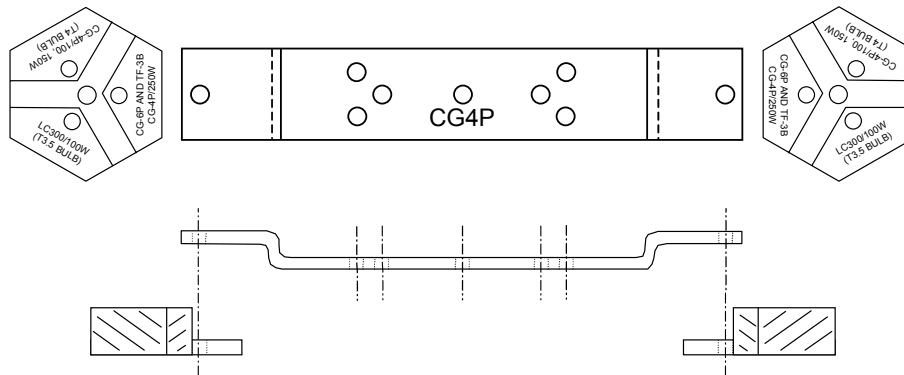


Figure 6-54. Lampchanger Bracket and Spacer Orientation for 120-volt, 250 watt Installation.

b. Flashing:

- (1) Open the range lantern door, and lock the door in the open position.
- (2) Insert the power cable through the cable gland. **INSURE THAT POWER IS SECURED.** Terminate the leads with spring spade lugs sized for a #8 stud. Wire the cable to the terminal block on the back wall of the lantern, and tighten the cable gland.
- (3) Remove the pipe plug from the $\frac{3}{4}$ " NPT threaded hole. Insert the photoresistor leads for a Type L daylight control through the hole. Screw the daylight control into the threaded hole and tighten gently with a wrench.
- (4) Using the "AC Installation Kit" that came with the lantern, attach the color-coded wires to a CG-4P lampchanger.
- (5) Mount the CG-4P to the lampchanger bracket, with the bracket oriented so that the label "CG4P" is up.
- (6) Mount a FLAC-300 flasher to the lampchanger bracket.
- (7) Wire the FLAC-300 and CG-4P lampchanger together, using the wires that come with the FLAC-300, as illustrated in Data Sheet 6-E(8).
- (8) Wire the Type L daylight control to the FLAC-300 flasher.
- (9) Rotate the spacer blocks located at the back of the lantern drum so the lampchanger bracket will rest over the spaces marked for the CG-4P AND for the selected lamp (150 or 250 watt), as illustrated in figure 6-53 and figure 6-54.
- (10) Mount the lampchanger/flasher assembly on the spacer blocks using the screws, flat washers, and lock washers provided.
- (11) Wire the AC installation kit leads that are installed on the CG-4P to the terminal block.
- (12) Dress any loose wires.
- (13) Close the range lantern door and carefully latch all the latches.
- (14) Turn 120-volt power on.

Data Sheet 6-E(20). (cont'd).

Mounting, Leveling & Alignment. The RL14 range lantern requires precision leveling and alignment. The mounting pattern for the RL14 has three equally spaced 7/16" holes on a 14³/₄" (375mm) bolt circle. Use 3/8" bolts, which are passed through the leveling bolts, to secure the range lantern to the lantern stand. Prior to tightening the mounting bolts, level the range lantern by adjusting the leveling bolts (see figure 6-55). After the range lantern is leveled and the mounting bolts tightened, loosen the three clamp bolts (see figure 6-56) and rotate the drum to the desired direction. Figure 6-57 illustrates the sight picture for alignment. Final alignment may require placing an observation vessel on the centerline at the far end of the channel, especially for long channels or when a spread lens is not used. Slowly sweep the beam back and forth across the channel until the observer indicates that the intensity of the signal light is at its peak. Tighten the clamp bolts, and recheck the leveling. Relevel the range lantern, if necessary.



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6.E.

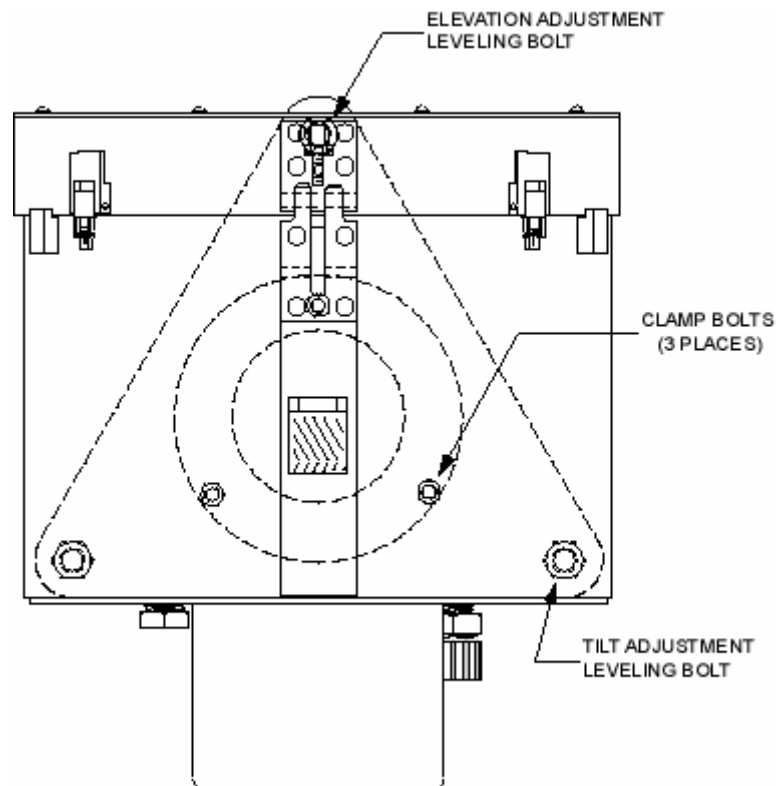


Figure 6-56. Leveling & Alignment Adjustments for RL14 Range Lantern

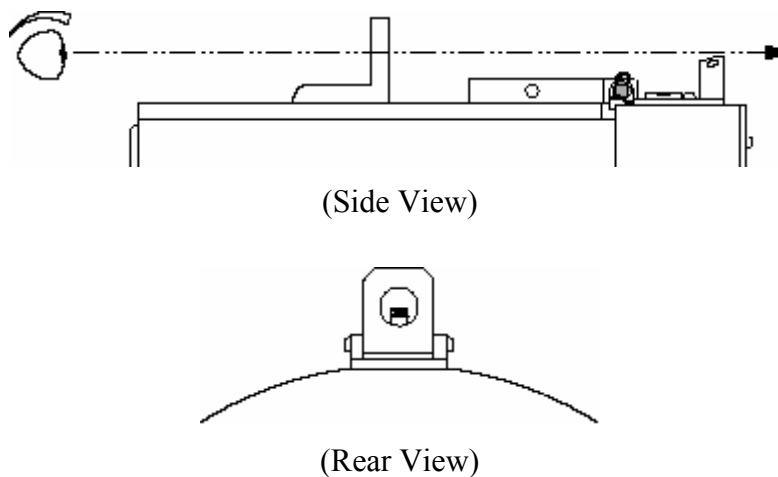


Figure 6-57. Sight Picture for Alignment of the RL14 Range Lantern

Performance Characteristics. The performance characteristics of the RL14 range lantern, for all lamps and available spread lenses, are provided in Table 6-17 (white), Table 6-18 (red) and Table 6-19 (green)

Data Sheet 6-E(20). (cont'd).

6.E.

Table 6-17.
RL14 Effective Intensities—White.

RHYTHM:		Q	ISO 2 / FL 2.5(1) OCC 4 / ISO 6		F
CONTACT CLOSURE TIME:		0.3	1.0	3.0	FIXED
LENS:	LAMP:				
FLAT	12VDC 0.25A	N/A	N/A	N/A	N/A
	0.55A	N/A	N/A	N/A	N/A
	0.77A	N/A	N/A	N/A	N/A
	1.15A	N/A	N/A	N/A	N/A
	2.03A	N/A	N/A	N/A	N/A
	3.05A	N/A	N/A	N/A	N/A
	12VDC 1.0A	83,000	140,000	160,000	180,000
	1.9A	100,000	200,000	240,000	260,000
	3.0A	N/A	320,000	380,000	410,000
	12VDC 35W	N/A	530,000	630,000	690,000
	50W	N/A	600,000	760,000	820,000
	75W	N/A	740,000	960,000	1,000,000
	100W	N/A	920,000	1,200,000	1,300,000
	110W	N/A	980,000	1,300,000	1,500,000
	120VAC150W	340,000	610,000	700,000	760,000
	250W	290,000	590,000	700,000	750,000
	3 DEG 12VDC0.25A	7,300	11,000	13,000	14,000
	0.55A	18,000	29,000	34,000	36,000
	0.77A	24,000	40,000	45,000	49,000
	1.15A	35,000	62,000	72,000	77,000
	2.03A	54,000	110,000	130,000	140,000
	3.05A	N/A	150,000	180,000	200,000
	12VDC 1.0A	29,000	50,000	58,000	62,000
	1.9A	43,000	83,000	99,000	110,000
	3.0A	N/A	140,000	170,000	180,000
	12VDC 35W	N/A	190,000	230,000	250,000
	50W	N/A	240,000	310,000	330,000
	75W	N/A	330,000	430,000	470,000
	100W	N/A	440,000	590,000	640,000
	110W	N/A	450,000	610,000	670,000
	120VAC150W	190,000	330,000	390,000	420,000
	250W	180,000	360,000	430,000	470,000

Data Sheet 6-E(20). (cont'd).

6.E.

Table 6-17.
RL14 Effective Intensities—White (cont'd).

RHYTHM: CONTACT CLOSURE TIME:			Q	ISO 2 / FL 2.5(1)	OCC 4 / ISO 6	F
			0.3	1.0	3.0	FIXED
LENS:	LAMP:					
8 DEG	12VDC	0.25A	2,800	4,300	4,800	5,200
		0.55A	8,400	14,000	16,000	17,000
		0.77A	10,000	17,000	19,000	21,000
		1.15A	16,000	28,000	33,000	35,000
		2.03A	26,000	51,000	61,000	66,000
		3.05A	N/A	79,000	94,000	100,000
	12VDC	1.0A	13,000	23,000	26,000	28,000
		1.9A	20,000	39,000	46,000	50,000
		3.0A	N/A	65,000	78,000	85,000
	12VDC	35W	N/A	90,000	110,000	120,000
		50W	N/A	120,000	150,000	160,000
		75W	N/A	160,000	200,000	220,000
		100W	N/A	220,000	290,000	320,000
		110W	N/A	220,000	300,000	330,000
	120VAC	150W	100,000	180,000	210,000	230,000
		250W	110,000	220,000	260,000	280,000
11 DEG	12VDC	0.25A	2,000	3,000	3,400	3,700
		0.55A	5,900	9,600	11,000	12,000
		0.77A	7,600	12,000	14,000	15,000
		1.15A	12,000	21,000	24,000	26,000
		2.03A	19,000	37,000	45,000	48,000
		3.05A	N/A	56,000	67,000	73,000
	12VDC	1.0A	11,000	20,000	23,000	24,000
		1.9A	16,000	31,000	37,000	40,000
		3.0A	N/A	53,000	63,000	69,000
	12VDC	35W	N/A	73,000	87,000	95,000
		50W	N/A	94,000	120,000	130,000
		75W	N/A	130,000	160,000	180,000
		100W	N/A	170,000	230,000	250,000
		110W	N/A	180,000	240,000	260,000
	120VAC	150W	78,000	140,000	160,000	170,000
		250W	84,000	170,000	200,000	220,000

Data Sheet 6-E(20). (cont'd).

6.E.

Table 6-17.
RL14 Effective Intensities—White (cont'd).

RHYTHM: CONTACT CLOSURE TIME:			Q	ISO 2 / FL 2.5(1)	OCC 4 / ISO 6	F
			0.3	1.0	3.0	FIXED
LENS:	LAMP:					
20 DEG	12VDC	0.25A	1,100	1,600	1,900	2,000
		0.55A	3,300	5,300	6,100	6,600
		0.77A	4,200	6,700	7,700	8,300
		1.15A	6,400	11,000	13,000	14,000
		2.03A	10,000	20,000	24,000	26,000
		3.05A	N/A	30,000	36,000	40,000
	12VDC	1.0A	5,100	8,800	10,000	11,000
		1.9A	7,600	15,000	18,000	19,000
		3.0A	N/A	25,000	30,000	33,000
	12VDC	35W	N/A	33,000	39,000	43,000
		50W	N/A	44,000	55,000	60,000
		75W	N/A	61,000	79,000	86,000
		100W	N/A	84,000	110,000	120,000
		110W	N/A	84,000	110,000	130,000
	120VAC	150W	41,000	73,000	85,000	91,000
		250W	44,000	89,000	110,000	110,000
28 DEG	12VDC	0.25A	860	1,300	1,500	1,600
		0.55A	2,600	4,100	4,700	5,100
		0.77A	3,100	4,900	5,700	6,100
		1.15A	4,900	8,600	10,000	11,000
		2.03A	7,600	15,000	18,000	19,000
		3.05A	N/A	23,000	28,000	30,000
	12VDC	1.0A	3,900	6,600	7,600	8,200
		1.9A	5,900	11,000	14,000	15,000
		3.0A	N/A	20,000	23,000	25,000
	12VDC	35W	N/A	22,000	26,000	28,000
		50W	N/A	33,000	42,000	46,000
		75W	N/A	47,000	61,000	66,000
		100W	N/A	63,000	83,000	91,000
		110W	N/A	64,000	87,000	96,000
	120VAC	150W	32,000	57,000	66,000	71,000
		250W	35,000	71,000	85,000	91,000

Data Sheet 6-E(20). (cont'd).

6.E.

Table 6-18.
RL14 Effective Intensities—Green.

RHYTHM: CONTACT CLOSURE TIME:			Q	ISO 2 / FL 2.5(1) OCC 4 / ISO 6		F
			0.3	1.0	3.0	FIXED
LENS:	LAMP:					
FLAT	12VDC	0.25A	N/A	N/A	N/A	N/A
		0.55A	N/A	N/A	N/A	N/A
		0.77A	N/A	N/A	N/A	N/A
		1.15A	N/A	N/A	N/A	N/A
		2.03A	N/A	N/A	N/A	N/A
		3.05A	N/A	N/A	N/A	N/A
	12VDC	1.0A	19,000	33,000	38,000	41,000
		1.9A	24,000	47,000	56,000	60,000
		3.0A	N/A	73,000	87,000	95,000
	12VDC	35W	N/A	130,000	150,000	160,000
		50W	N/A	140,000	180,000	200,000
		75W	N/A	180,000	230,000	250,000
		100W	N/A	220,000	290,000	320,000
		110W	N/A	230,000	320,000	350,000
	120VAC	150W	85,000	150,000	180,000	190,000
		250W	74,000	150,000	180,000	190,000
3 DEG	12VDC	0.25A	1,700	2,600	2,900	3,100
		0.55A	4,200	6,700	7,700	8,300
		0.77A	5,600	9,100	10,000	11,000
		1.15A	8,000	14,000	16,000	18,000
		2.03A	12,000	25,000	30,000	32,000
		3.05A	N/A	35,000	42,000	46,000
	12VDC	1.0A	6,700	11,000	13,000	14,000
		1.9A	9,800	19,000	23,000	25,000
		3.0A	N/A	32,000	38,000	42,000
	12VDC	35W	N/A	45,000	54,000	59,000
		50W	N/A	58,000	74,000	80,000
		75W	N/A	79,000	100,000	110,000
		100W	N/A	110,000	140,000	150,000
		110W	N/A	110,000	150,000	160,000
	120VAC	150W	47,000	83,000	96,000	100,000
		250W	45,000	91,000	110,000	120,000

Data Sheet 6-E(20). (cont'd).

6.E.

Table 6-18.
RL14 Effective Intensities—Green (cont'd).

RHYTHM: CONTACT CLOSURE TIME:			Q	ISO 2 / FL 2.5(1)	OCC 4 / ISO 6	F
			0.3	1.0	3.0	FIXED
LENS:	LAMP:					
8 DEG	12VDC	0.25A	650	980	1,100	1,200
		0.55A	1,900	3,100	3,600	3,900
		0.77A	2,400	3,800	4,400	4,700
		1.15A	3,600	6,500	7,500	8,100
		2.03A	5,900	12,000	14,000	15,000
		3.05A	N/A	18,000	22,000	23,000
	12VDC	1.0A	3,100	5,200	6,100	6,500
		1.9A	4,600	8,900	11,000	11,000
		3.0A	N/A	15,000	18,000	20,000
	12VDC	35W	N/A	22,000	26,000	28,000
		50W	N/A	28,000	35,000	38,000
		75W	N/A	37,000	48,000	53,000
		100W	N/A	53,000	70,000	77,000
		110W	N/A	54,000	73,000	80,000
	120VAC	150W	26,000	46,000	53,000	57,000
		250W	27,000	55,000	65,000	70,000
11 DEG	12VDC	0.25A	460	700	790	850
		0.55A	1,400	2,200	2,500	2,700
		0.77A	1,700	2,800	3,300	3,500
		1.15A	2,700	4,700	5,500	5,900
		2.03A	4,300	8,600	10,000	11,000
		3.05A	N/A	13,000	15,000	17,000
	12VDC	1.0A	2,600	4,500	5,200	5,600
		1.9A	3,700	7,100	8,500	9,100
		3.0A	N/A	12,000	15,000	16,000
	12VDC	35W	N/A	18,000	21,000	23,000
		50W	N/A	23,000	28,000	31,000
		75W	N/A	30,000	39,000	43,000
		100W	N/A	42,000	55,000	60,000
		110W	N/A	42,000	58,000	63,000
	120VAC	150W	19,000	35,000	40,000	43,000
		250W	21,000	42,000	50,000	54,000

Data Sheet 6-E(20). (cont'd).

6.E.

Table 6-18.
RL14 Effective Intensities—Green (cont'd).

RHYTHM: CONTACT CLOSURE TIME:			Q	ISO 2 / FL 2.5(1)	OCC 4 / ISO 6	F
			0.3	1.0	3.0	FIXED
LENS:	LAMP:					
20 DEG	12VDC	0.25A	250	380	430	460
		0.55A	760	1,200	1,400	1,500
		0.77A	950	1,500	1,800	1,900
		1.15A	1,500	2,600	3,000	3,300
		2.03A	2,300	4,600	5,500	5,900
		3.05A	N/A	7,000	8,400	9,100
	12VDC	1.0A	1,200	2,000	2,300	2,500
		1.9A	1,700	3,400	4,000	4,300
		3.0A	N/A	5,800	6,900	7,500
	12VDC	35W	N/A	7,900	9,400	10,000
		50W	N/A	10,000	13,000	14,000
		75W	N/A	15,000	19,000	21,000
		100W	N/A	20,000	27,000	29,000
		110W	N/A	20,000	27,000	30,000
	120VAC	150W	10,000	18,000	21,000	23,000
		250W	11,000	22,000	27,000	29,000
28 DEG	12VDC	0.25A	200	300	340	370
		0.55A	590	950	1,100	1,200
		0.77A	700	1,100	1,300	1,400
		1.15A	1,100	2,000	2,300	2,500
		2.03A	1,700	3,500	4,100	4,500
		3.05A	N/A	5,300	6,300	6,900
	12VDC	1.0A	890	1,500	1,800	1,900
		1.9A	1,300	2,600	3,100	3,400
		3.0A	N/A	4,500	5,400	5,900
	12VDC	35W	N/A	5,200	6,300	6,800
		50W	N/A	8,000	10,000	11,000
		75W	N/A	11,000	15,000	16,000
		100W	N/A	15,000	20,000	22,000
		110W	N/A	15,000	21,000	23,000
	120VAC	150W	8,000	14,000	17,000	18,000
		250W	8,900	18,000	21,000	23,000

Data Sheet 6-E(20). (cont'd).

6.E.

Table 6-19.
RL14 Effective Intensities—Red.

RHYTHM: CONTACT CLOSURE TIME:			Q	ISO 2 / FL 2.5(1)	OCC 4 / ISO 6	F
			0.3	1.0	3.0	FIXED
LENS:	LAMP:					
FLAT	12VDC	0.25A	N/A	N/A	N/A	N/A
		0.55A	N/A	N/A	N/A	N/A
		0.77A	N/A	N/A	N/A	N/A
		1.15A	N/A	N/A	N/A	N/A
		2.03A	N/A	N/A	N/A	N/A
		3.05A	N/A	N/A	N/A	N/A
	12VDC	1.0A	15,000	26,000	30,000	32,000
		1.9A	19,000	37,000	44,000	47,000
		3.0A	N/A	57,000	68,000	74,000
	12VDC	35W	N/A	79,000	95,000	100,000
		50W	N/A	90,000	110,000	120,000
		75W	N/A	110,000	140,000	160,000
		100W	N/A	140,000	180,000	200,000
		110W	N/A	150,000	200,000	220,000
	120VAC	150W	65,000	120,000	130,000	140,000
		250W	56,000	110,000	130,000	140,000
3 DEG	12VDC	0.25A	1,300	2,000	2,300	2,400
		0.55A	3,300	5,300	6,100	6,500
		0.77A	4,400	7,100	8,200	8,800
		1.15A	6,200	11,000	13,000	14,000
		2.03A	9,800	20,000	23,000	25,000
		3.05A	N/A	28,000	33,000	36,000
	12VDC	1.0A	5,200	8,900	10,000	11,000
		1.9A	7,700	15,000	18,000	19,000
		3.0A	N/A	25,000	30,000	33,000
	12VDC	35W	N/A	28,000	34,000	37,000
		50W	N/A	37,000	46,000	50,000
		75W	N/A	50,000	64,000	70,000
		100W	N/A	67,000	89,000	96,000
		110W	N/A	67,000	91,000	100,000
	120VAC	150W	35,000	63,000	73,000	79,000
		250W	35,000	69,000	82,000	89,000

Data Sheet 6-E(20). (cont'd).

6.E.

Table 6-19.
RL14 Effective Intensities—Red (cont'd).

RHYTHM: CONTACT CLOSURE TIME:			Q	ISO 2 / FL 2.5(1)	OCC 4 / ISO 6	F
			0.3	1.0	3.0	FIXED
LENS:	LAMP:					
8 DEG	12VDC	0.25A	510	770	870	940
		0.55A	1,500	2,400	2,800	3,000
		0.77A	1,900	3,000	3,400	3,700
		1.15A	2,900	5,100	5,900	6,300
		2.03A	4,600	9,200	11,000	12,000
		3.05A	N/A	14,000	17,000	18,000
	12VDC	1.0A	2,400	4,100	4,700	5,100
		1.9A	3,600	7,000	8,300	8,900
		3.0A	N/A	12,000	14,000	15,000
	12VDC	35W	N/A	14,000	16,000	18,000
		50W	N/A	17,000	22,000	24,000
		75W	N/A	23,000	30,000	33,000
		100W	N/A	33,000	44,000	48,000
		110W	N/A	33,000	45,000	50,000
	120VAC	150W	20,000	35,000	40,000	44,000
		250W	21,000	41,000	49,000	53,000
11 DEG	12VDC	0.25A	360	550	620	670
		0.55A	1,100	1,700	2,000	2,100
		0.77A	1,400	2,200	2,500	2,700
		1.15A	2,100	3,700	4,300	4,600
		2.03A	3,400	6,700	8,000	8,600
		3.05A	N/A	10,000	12,000	13,000
	12VDC	1.0A	2,100	3,500	4,100	4,400
		1.9A	2,900	5,600	6,600	7,100
		3.0A	N/A	9,500	11,000	12,000
	12VDC	35W	N/A	11,000	13,000	14,000
		50W	N/A	14,000	18,000	19,000
		75W	N/A	19,000	24,000	27,000
		100W	N/A	26,000	35,000	38,000
		110W	N/A	27,000	36,000	40,000
	120VAC	150W	15,000	26,000	31,000	33,000
		250W	16,000	32,000	38,000	41,000

Data Sheet 6-E(20). (cont'd).

6.E.

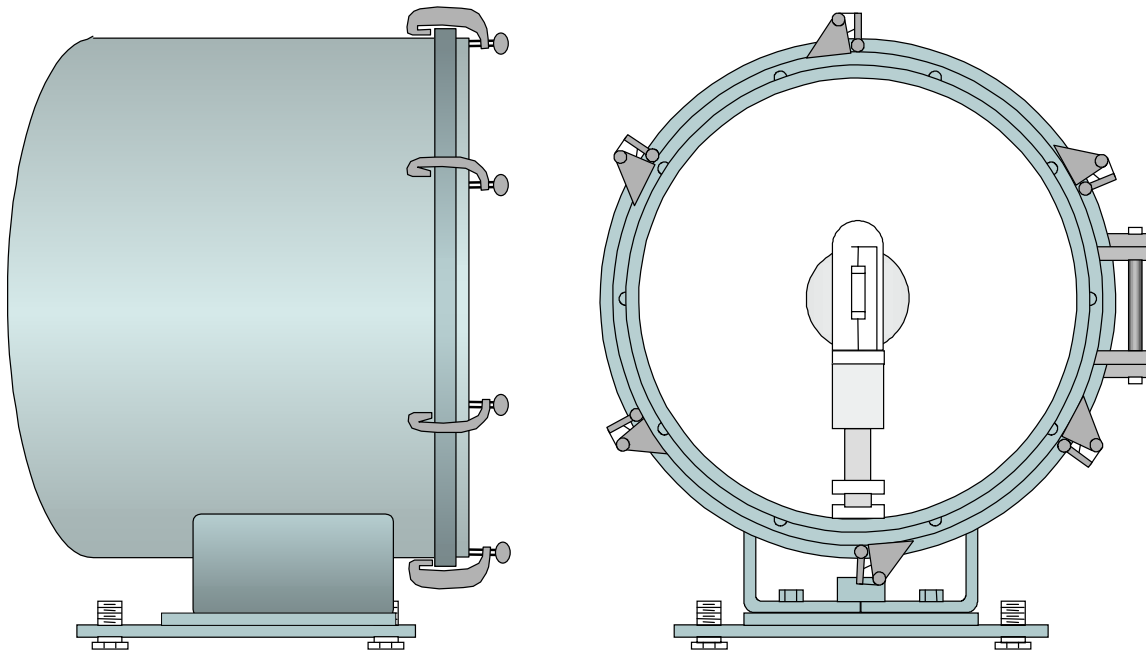
Table 6-19.
RL14 Effective Intensities—Red (cont'd).

RHYTHM: CONTACT CLOSURE TIME:			Q	ISO 2 / FL 2.5(1)	OCC 4 / ISO 6	F
			0.3	1.0	3.0	FIXED
LENS:	LAMP:					
20 DEG	12VDC	0.25A	190	300	330	360
		0.55A	590	960	1,100	1,200
		0.77A	750	1,200	1,400	1,500
		1.15A	1,200	2,000	2,400	2,600
		2.03A	1,800	3,600	4,300	4,600
		3.05A	N/A	5,500	6,600	7,100
	12VDC	1.0A	930	1,600	1,800	2,000
		1.9A	1,400	2,700	3,200	3,400
		3.0A	N/A	4,500	5,400	5,900
	12VDC	35W	N/A	4,900	5,900	6,400
		50W	N/A	6,500	8,200	8,900
		75W	N/A	9,200	12,000	13,000
		100W	N/A	13,000	17,000	18,000
		110W	N/A	13,000	17,000	19,000
	120VAC	150W	7,800	14,000	16,000	17,000
		250W	8,400	17,000	20,000	22,000
28 DEG	12VDC	0.25A	160	240	270	290
		0.55A	460	740	850	920
		0.77A	550	890	1,000	1,100
		1.15A	870	1,600	1,800	1,900
		2.03A	1,400	2,700	3,200	3,500
		3.05A	N/A	4,200	5,000	5,400
	12VDC	1.0A	690	1,200	1,400	1,500
		1.9A	1,100	2,100	2,500	2,600
		3.0A	N/A	3,500	4,200	4,600
	12VDC	35W	N/A	3,300	3,900	4,300
		50W	N/A	5,000	6,300	6,800
		75W	N/A	7,100	9,200	9,900
		100W	N/A	9,400	13,000	14,000
		110W	N/A	9,600	13,000	14,000
	120VAC	150W	6,100	11,000	13,000	13,000
		250W	6,700	13,000	16,000	17,000

Data Sheet 6-E(20). (cont'd).

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RL24 Range Lantern



Function. The RL24 range lantern emits a high intensity pencil beam for use as a range light. It is outfitted with the 120-volt, 1000 watt tungsten-halogen lamp. The RL24 range lantern must be installed on a stable platform.

Features.

- Aluminum base and housing.
- Lampchanger provided.
- Requires precision focusing and leveling.
- Replaceable clear, green, or red cover glasses.

Related Equipment. The RL24 range lantern is outfitted with the CG-2P lampchanger and 120-volt, 1000 watt tungsten-halogen lamps. The lantern may be daylight controlled with a Type K daylight control, or flashed using the AC Flash Controller with the appropriate CG-181/493 flasher installed (see Chapter 9). Daylight control of a flashed lantern is performed using a Type L daylight control with the AC Flash Controller.

Wiring & Component Installation. The RL24 range lantern is completely wired internally prior to shipment from the manufacturer. A length of four-conductor cable extends out through a watertight stuffing tube. Wiring the RL24 range lantern merely requires connecting the hot line, neutral, lamp failure indicator (if used), and equipment ground to the end of the power cable.

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Note, the procedures listed below are for stand-alone range lanterns. Day/night ranges are controlled by a Range Switch Box-AC (see Chapter 9). The wiring schematic for a 120VAC day/night range system is illustrated in Ocean Engineering Drawing 130503.

- a. Fixed-on: Stand-alone RL24 range lanterns burning fixed-on, 24 hours per day may be wired through a disconnect to 120VAC power. RL24 range lanterns that have a fixed-on rhythm may be daylight controlled using a Type K daylight control.
- b. Flashed: RL24 range lanterns that display a flashing rhythm are controlled using an AC Flash Controller. The AC Flash Controller may be daylight controlled using a Type L daylight control.

Mounting, Leveling & Alignment. The RL24 range lantern requires precision leveling and alignment. The mounting pattern is three equally spaced $\frac{1}{2}$ " holes on a $14\frac{3}{4}$ " (375mm) bolt circle. Use $\frac{1}{2}$ " bolts, which are passed through the leveling bolts, to secure the range lantern to the lantern stand. Prior to tightening the mounting bolts, level the range lantern by adjusting the leveling bolts. After the range lantern is leveled and the mounting bolts tightened, loosen the four clamp bolts and rotate the drum to the desired direction. Final alignment may require placing an observation vessel on the centerline at the far end of the channel, especially for long channels. Slowly sweep the beam back and forth across the channel until the observer indicates that the intensity of the signal light is at its peak. Tighten the clamp bolts, and recheck the level. Relevel the range lantern, if necessary.

Focusing. The optical system of a DCB24/224 rotating beacon is accurately focused by the manufacturer. Adjustments are not necessary unless the optical system has been changed, such as when a mirror or lampchanger is replaced. Focusing adjustments are NOT required when a lamp is replaced. Follow the procedures in the AC Servicing Guide, in the event that focusing is required.

Performance Characteristics. The performance characteristics of the RL24 range lantern are outlined in Table 6-20.

Table 6-20
Performance Characteristics of the RL24 Range Lantern.

Beam Width: 1.8° (full width to half maximum intensity)

Effective Intensities (in candela; for 1000 W lamp):

Rhythm:	Iso 2 / Fl 2.5(1)	Occ 4 / Iso 6	F
Contact Closure Time (sec):	1.0	3.0	Fixed
<u>Lens Color</u>			
WHITE	1,700,000	2,300,000	2,500,000
GREEN	350,000	460,000	500,000
RED	380,000	510,000	550,000

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Dimensions. The basic dimensions of the RL24 range lantern are outlined in figure 6-59. The weight of the lantern (uncrated) is approximately 160 lbs (73kg).

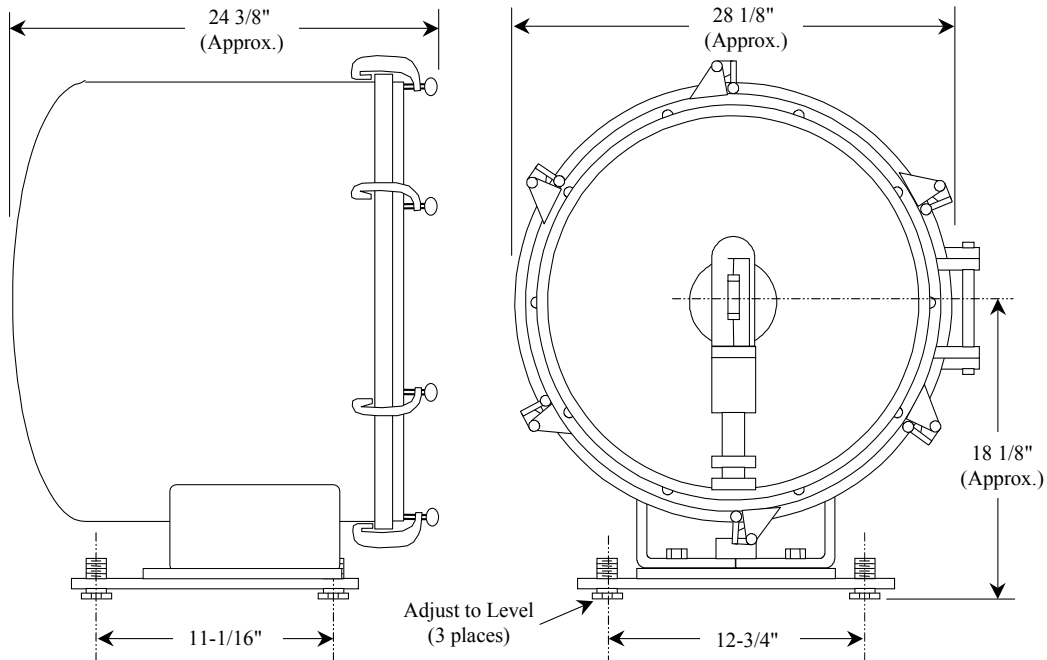


Figure 6-59. RL24 Range Lantern Dimensions.

Additional Data. The RL24 range lantern is stocked at Engineering Logistics Center, Baltimore, in Project 98A. Requests for the RL24 range lantern should be addressed to Commandant (G-SEC-2A). The manufacturer of the lanterns is The Carlisle and Finch Co., (513) 681-6080.

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Ice Buoy Lantern



Function. The ice buoy lantern is installed on 7x20 LI ice buoys, to provide a seasonal light signal in waters prone to heavy icing.

Features.

- LED technology
- Ice resistant housing eliminates the need for a Lexan ice dome
- Extremely durable and power efficient
- Uniform light output down to 10 VDC
- Daylight control built-in

Related Equipment. The ice buoy lantern is manufactured by Sabik of Finland. The lantern is modified to accept the CG-181/493 flasher, uses a stainless steel adapter plate to mate it to the 7x20 LI buoy, and is powered by the 320 AH ice buoy battery. A gasket is installed between the lantern's adapter plate and the buoy. The gasket, called a "Gasket Ice Buoy," is available from the ELC with stock number 2050-01-132-2310. A spare parts kit shipped to each CGC provides components that are typically lost or consumed during use (o-rings, bird spikes, etc.)

Power System. The power system uses the standard 320 AH ice buoy battery. The red, white, green and (yellow) LED lanterns draw 0.30 (0.37) amps and the RBDT is detailed in Table 9-6:

Performance. The lanterns have a 6-degree total divergence to 50% of peak intensity. The effective intensity and range in nautical miles are tabulated below:

Rhythm	<i>Effective Intensity in candela (range in nmi)</i>			
	White	Red	Green	Yellow
Fixed	66 (5)	54 (5)	77 (5)	58 (5)
Q, FL(2+1)6, FL2.5(.3)	39 (4)	32 (4)	46 (4)	34 (4)
Mo(A), FL4(.4)	44 (4)	36 (4)	51 (4)	38 (4)
FL6(.6)	49 (4)	40 (4)	57 (5)	43 (4)

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Internal Components. The lantern consists of three components; the LED circuit board assembly containing the LEDs, a LED Driver and daylight control. There is a precision resistor across the “Current Settings” terminals of the LED Driver that determines the intensity of the lantern. This resistor must be installed on the LED driver if it is replaced. The resistors are as follows:

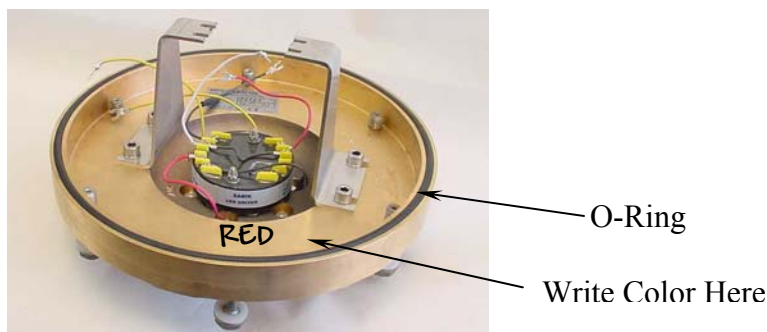
Red LED lantern	-	3300 ohms	(orange, orange, black, brown, brown)
Green LED lantern	-	3300 ohms	(orange, orange, black, brown, brown)
Yellow LED lantern	-	5110 ohms	(green, brown, brown, brown, brown)
White LED lantern	-	3570 ohms	(orange, green, violet, brown, brown)

Contact COMMANDANT (G-SEC-2A) if additional intensity is required for a special application as the resistance values can be changed to increase the range of the lantern to 5 nautical miles.

Dimensions. The lantern, excluding the adapter plate and bird spike, is 4” tall, 12” in diameter and weighs approximately 35 lbs.

Wiring and Installation. Unpack the lantern from the shipping container and check for damage. There is a red, green, white or yellow insert on the top of the lantern that indicates the color of the LEDs. All lenses are clear, so it may be worth writing, with an indelible ink marker, the LED color inside the base of the lantern. This will save time later as the lanterns will be stored upside down.

Remove the flasher brackets from the parts package and attach to the threaded holes in the base of the lantern, as shown below. Be sure that the slots in the bracket are seated against the bolts and visually look down at the top of the brackets to be sure that the slots for the flasher are opposite each other. Use the lock washer to keep them from vibrating loose. The Allen head bolts should be tightened with a 6mm Allen wrench. At this time install the O-ring gasket in the groove. Be sure that it’s fully seated.

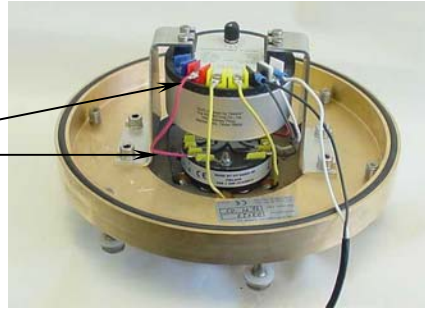


Attach a CG-181 or CG-493 flasher with four 10-32 x ½” stainless steel screws and split lock washers. Note the orientation of the flasher, as the leads from the LED driver will not reach if installed in the opposite direction, as shown on the next figure. Attach the 5 color-coded leads from lantern to the flasher, as shown.

Data Sheet 6-E(22). (cont'd).

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Note orientation of flasher terminals to red wire on LED



Set the flasher to the desired rhythm (if programmable flasher is used). Apply 12 VDC to the black (+) and white (-) terminals of the flasher and check for proper operation. Since the daylight control is located inside the lens, you will have to wrap a rag around the lens or operate in a darkened room for the light to turn on.

A custom stainless steel adapter plate (shipped separately) was fabricated to mate the lantern to a 7x20LI. The lantern contains an O-ring that seals it to the plate. Additional sealing can be obtained by running a bead of RTV around the base of the lantern. The bolts securing the lantern to the plate should be installed with Loctite 242 (blue) thread locker to prevent vibration from the ice flow that may loosen the fasteners. A $\frac{3}{4}$ " socket wrench may be used to tighten the bolts. Due to the difficulty in aligning the lantern to the plate, it is suggested that the lantern and plate be installed as one assembly. The plate is sealed to the buoy with the gasket referenced in the "Related Equipment" paragraph on the first page of this Data Sheet.



Attach approximately 42 inches of 12/2 SO cable to the ice buoy battery using ring lugs sized for a $\frac{1}{4}$ " stud. Install the battery in the pocket and attached the Ice Buoy Battery Clamp. Install a new gasket on the pocket cover. Pass the cable through the stuffing tube in the pocket cover and secure to the pocket. Do not over tighten - if the studs snap they are difficult to replace.

Support the lantern on a work stand under the buoy. Install a new rubber gasket on the studs in the buoy used to mount the adaptor plate. Attach the 12/2 SO cable from the battery pocket directly to the flasher. Lift the lantern into place - two people may be needed. Be sure to watch the pinching points between the adaptor plate and buoy. Feed the cable into the buoy and align the holes in the adapter plate with the studs on the buoy. Secure with flat washers and stainless steel nylon locking nuts.

Cover the lens with a jacket and after a few seconds, the lantern should start flashing on-rhythm.

Install one or more bird spikes in the top of the lantern. These spikes are sacrificial and will break off if the buoy is pulled under the ice. Extra spikes are provided with the lantern and in the

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spare parts kit. To remove broken spikes, heat the tip of a small screwdriver and press into the plastic to create a slot. When cool, try to remove the broken spike by turning the screwdriver counterclockwise. If that doesn't work, then the spike must be drilled out with a 13/64" bit and retapped with a 6mm – 1.0 hand tap.

Serviceing. Serviceing is not necessary during a routine ice season. Based on past performance, the operating temperature and the drive current of the LEDs, this lantern can remain in service for 20 ice seasons (possibly longer) if the lens and housing are still in good condition.

If an unscheduled visit is made to the aid, ensure that the lens is clean. Wipe with a cloth dampened with mild soap and water, if necessary. Cover the lantern with an opaque cloth or jacket to ensure that the lantern flashes on rhythm. Check to be sure all LEDs are lit through the lens of the lantern. Dark sectors indicate that some LEDs have failed and intensity will be reduced in that direction (there is enough overlap between LEDs to provide coverage if a few LEDs fail). If the lantern fails, or if more than 3 adjacent LEDs fail, replace the lantern and contact Commandant (G-SEC-2A) for disposition instructions.

Troubleshooting.

No light -

- Check battery voltage at flasher input terminals. Minimum voltage is 10 volts for the flasher to operate. No reduction in LED intensity will occur at this voltage. Replace wire or battery, if necessary.
- Cover the lens and measure voltage between flasher (L) and (-) terminals. If no voltage (on rhythm), disconnect daylight control leads. If still no voltage between (L) and (-), replace the flasher. If voltage is present, the daylight control in the lantern is bad. Since these are not serviceable either the lantern must be replaced, or the daylight control may be left disconnected. The low power consumption of the lantern will allow 24 hr operation without failure during a typical ice season using a 320 AH battery.
- If the flasher has output voltage, then replace the LED Driver. Note where the wires and jumpers are attached and either a new current setting resistor or the one from the old LED Driver must be installed.
- If a new LED Driver does not solve the problem, replace the entire lantern.

Improper rhythm - Replace the CG181/493 flasher. If using a MES/NIS flasher, place a 470 ohm, 5%, 1/2 watt resistor across the "L" and "-" terminals and retest.

LEDs out (dark sectors) - Replace lantern if more than 3 adjacent LEDs have failed.

Spare lanterns and spare parts. Spare lanterns and spare parts kits were provided to units that deploy ice buoys during the initial outfitting. Each spare parts kit contained:

12 O-Rings	12 Current Setting Resistors (for red & green)
24 M12x50 Captive Metric Bolts	6 Wire Harnesses
24 Plastic Washers for above	12 Flasher Brackets
50 Bird Spikes	24 M5x15 Allen Bolts for above
4 LED Drivers	

Requests for additional ice buoy lanterns and parts should be made to Commandant (G-SEC-2A). Data Sheet 6-E(22). (cont'd).

6.E.

Xenon Flashtube Beacon



Function. The XFB series xenon flashtube beacons provide a momentary, intense flash that improves the conspicuity of an aid. The xenon flashtube beacon must be used in conjunction with a standard light signal, as the short duration of the flash makes it difficult to visually determine the position of the aid. Xenon flashtube beacons are predominantly used on sea buoys, and on some vessel traffic separation buoys.

WARNING: Hazardous voltages are present in XFB series xenon flashtube beacons. The power supply provides a 400-volt pulse across the “T” and “G” terminals to a transformer in the flash head. The potential across power-supply terminals “A” and “K” builds from approximately 40-volts to 365-volts over a one-second period prior to each flash. After power is disconnected, allow fifteen (15) minutes for the energy storage circuit (capacitors) to discharge, or discharge the capacitors by installing an insulated jumper across terminals “A” and “K.”

Features.

- Designed for 10 to 15-volt DC operation.
- Three versions available (designated by output in Joules per flash): XFB-001, XFB-005 and XFB-010.
- Comprised of two components—the flash head, and the power supply unit.
- Field-replaceable timer PROM on programmable timer board.
- Mounts in the 155mm buoy lantern using standard 155mm lampchanger bracket.
- Minimum flash rhythm of 1 second, with a 200 microsecond flash duration.
- Provisions for daylight control.

Data Sheet 6-E(23). Xenon Flashtube Beacon

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Electrical and Mechanical Characteristics.

- Input voltage10 to 15 volts DC
- Maximum current draw.....2.5 amps (XFB-005 and XFB-010)
- Height
Completed assembly12" (305mm)
Power Unit5" (127mm)
Flash Head3½" (89mm)
- Diameter.....5" (127mm)
- Weight
Power Unit2.5 lbs (1.14kg)
Flash Head0.6 lbs (0.27kg)

Related equipment. The XFB series xenon flashtube beacons must be installed in a 155mm lantern, and is mounted to a standard 155mm lampchanger bracket. However, the bracket is installed “upside down.” Xenon flashtube beacons improve the conspicuity of an aid, and must be used in conjunction with a standard 155mm lantern. The flashtube beacon uses an external daylight control that is ordered from API (part number 9001-0317).

Wiring. Figure 6-61 illustrates the wiring schematic for the xenon flashtube beacon.

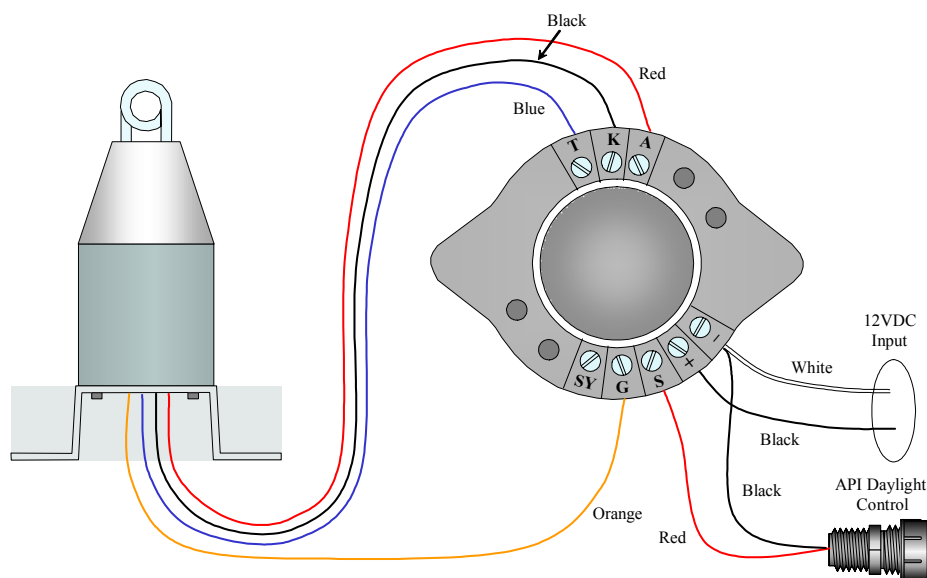


Figure 6-61. Wiring Schematic for the Xenon Flashtube Beacon

Installation. Use four 10-32 x ½" screws to mount the flash head assembly and power supply unit to an inverted 155mm lampchanger bracket. The flash head assembly comes with a standoff, to raise the flashtube to the focal plane of the lens. The flash head/power supply assembly is then mounted on the bracket supports in the 155mm lantern base. Follow instructions for in Data Sheet 6-E(13) to mount the lantern on a buoy.

Data Sheet 6-E(23). (cont'd).

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Focusing. The 155mm lantern is a prefocused optic, the focus is not adjustable. Inspect the lampchanger bracket and flash head standoff to insure that they are not bent. Install the flash head/power supply assembly with the lock washers on top of the lampchanger bracket.

Performance. The performance characteristics of the 155mm buoy lantern outfitted with the xenon flashtube beacon are provided in Table 6-22.

Table 6-22
Xenon Flashtube Beacon Performance in a 155mm Lantern

Mean horizontal intensity (cd)	XFB-001	XFB-050	XFB-010
clear lens	85	425	850
red lens	26	130	250
green lens	27	135	270
yellow lens	58	290	580

Additional Data. The XFB series xenon flashtube beacons and components may be purchased as commercial-off-the-shelf (COTS) items from Automatic Power, Inc. (API), (713) 228-5208. The original version of the XFB series flash head has the flashtube potted to the flash head assembly. API has developed a new version, for use in non-explosive environments, which allows for replacement of the flashtube. The following are applicable API part numbers for the beacon components:

- Power Supply Unit:
 - XFB-0109010-0186
 - XFB-0509010-0185
 - XFB-0109010-0181
 - Daylight Control.....9001-0317
- Flash Head:
 - Potted version9001-0295
 - Non-potted version9001-0641
 - Lamp assembly9001-0639 (for use with non-potted version only)
 - Lower assembly9001-0640 (non-potted version, without the lamp assembly)

Instructions on computing the power requirements of the XFB series beacons are detailed in Chapter 5 of the Solar Design Manual.

6.E.

Self Contained LED Lantern



Function. The Carmanah 700-series lanterns are self-powered, omni-directional LED lanterns. They are specifically adapted for use on a modified 5th class foam buoy; this buoy/lantern combination functions as a replacement for the old lighted discrepancy buoy, which has been discontinued. Use on other platforms and AtoN stations is permitted at the discretion of district aids to navigation offices.

Features.

- Bolts to existing lantern stands sized for 155mm lanterns.
- Self-contained optic, flasher, battery, solar panels and daylight control.
- Replaceable components.
- 3 year prorated warranty.

Related Equipment. Carmanah external battery charger, TV remote or Carmanah programmer.

Models. The Carmanah 700-series lanterns are available in three models: the 701, 702 and 702-5. All three models produce the same light intensities; the difference is the size of the solar panels and internal battery. The 701 has the least capable power system; the 702-5 has the most capable power system.

Light Characteristics. Every lantern has an inherent color (red, green, white or yellow). Flash rhythms are programmable.

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Performance Characteristics. The performance characteristics of the 700 Series LED buoy lantern are provided in Table 6-23.

Table 6-23
Performance Characteristics – Carmanah 700 Series LED Lantern

Effective Intensities (cd):

Characteristic:	FL 2.5 (0.3)	FL 4	FL 6	FL (2) 5	FL (2+1) 6	Mo(A)	Q
Effective Intensity:	15	17	19	17	15	14	13

Vertical Divergence (to 50% of maximum intensity):

Green lanterns: $\pm 3.5^\circ$

Red lanterns: $\pm 2.8^\circ$

Nominal Range: the nominal range for all characteristics listed above is 3 nautical miles.

Selection Criteria - Intensity. At the discretion of the district aids to navigation office, Carmanah lanterns can be used to replace 155mm lanterns on select aids to navigation. Replacing a 155mm with a Carmanah will result in a decrease in intensity, and therefore a reduction in service to the mariner. It is important that Districts carefully evaluate the reduction in intensity prior to authorizing a change. This is particularly important for white and yellow lights because of the very large intensity differences between Carmanah and 155mm lanterns for these colors.

To determine the intensity requirements for any aid, Districts use the standard procedures for selecting an AtoN light signal as prescribed at the beginning of this Chapter (page 6-1) and in the Visual Signal Design Manual (Chapter 3). These references describe how operational range, luminous range, light color, light characteristic, background lighting, and meteorological visibility are used to calculate intensity needs.

Selection Criteria – Solar Sizing. **If**, and only if the District has determined that a Carmanah will provide an intensity that meets the operational needs for a specific aid, **then** the next step is to choose a Carmanah model that has a power system matched to the aid location and flash characteristic. Use Table 6-24 to select a Carmanah model. Note that the green lanterns are sized differently than the red, white or amber (yellow). Note also that some location/flash-characteristic combinations have an “N/A” (particularly in Districts 13 and 17). “N/A” means that no Carmanah model can be used because the power system cannot power the aid with the available solar radiation.

Data Sheet 6-E(24). (cont’d).

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Table 6-24
Carmanah Solar Sizing Table

Color:	Green	Red White Yellow	Green	Red White Yellow	Green	Red White	Green	Red White Yellow
Characteristic:	FL 4 FL 6	FL 4 FL 6	FL 2.5 (0.3s)	FL 2.5 (0.3s)	FL(2+1)6	FL(2+1)6 FL (2) 5	Q	Q Mo (A)
Portland, ME	701	701	701	702	701	702	702	702-5
Boston, MA	701	701	701	702	701	702	702	702-5
Providence, RI	701	701	701	702	701	702	702	702-5
Bridgeport, CT	701	701	701	702	701	702	702	702-5
New York, NY	701	701	701	702	701	702	702	702-5
Albany, NY	701	701	701	702	701	702	702	N/A
Burlington, VT	701	701	701	702	701	702	702	N/A
Newark, NJ	701	701	701	702	701	702	702	702-5
Atlantic City, NJ	701	701	701	701	701	702	702	702
Wilmington, DE	701	701	701	701	701	702	702	702
Philadelphia, PA	701	701	701	701	701	702	702	702
Baltimore, MD	701	701	701	701	701	702	702	702
Sterling, VA	701	701	701	701	701	702	702	702
Norfolk, VA	701	701	701	701	701	702	702	702
Cape Hatteras, NC	701	701	701	701	701	701	701	702
Wilmington, NC	701	701	701	701	701	701	701	702
Charleston, SC	701	701	701	701	701	701	701	702
Savannah, GA	701	701	701	701	701	701	701	702
Jacksonville, FL	701	701	701	701	701	701	701	702
Daytona Beach, FL	701	701	701	701	701	701	701	702
West Palm Beach, FL	701	701	701	701	701	701	701	702
Miami, FL	701	701	701	701	701	701	701	702
San Juan, PR	701	701	701	701	701	701	701	702
Key West, FL	701	701	701	701	701	701	701	702
Tampa, FL	701	701	701	701	701	701	701	702
Tallahassee, FL	701	701	701	701	701	701	701	702
Mobile, AL	701	701	701	701	701	701	701	702
New Orleans, LA	701	701	701	701	701	701	701	702
Port Arthur, TX	701	701	701	701	701	701	701	702
Houston, TX	701	701	701	701	701	701	701	702
Corpus Christi, TX	701	701	701	701	701	701	701	702
Brownsville, TX	701	701	701	701	701	701	701	702
Little Rock, AR	701	701	701	701	701	702	701	702
Fort Smith, AR	701	701	701	701	701	701	701	702

- Notes: 1. Numbers in table refer to Carmanah Model number.
2. "N/A" means that no Carmanah can provide the desired characteristic.
3. If a desired characteristic is not listed contact Commandant (G-SEC-2).
4. Contact Commandant (G-SEC-2) for sizing information for seasonal aids.

Data Sheet 6-E(24). (cont'd).

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Table 6-24
Carmanah Solar Sizing Table (continued)

Color:	Green	Red White Yellow	Green	Red White Yellow	Green	Red White	Green	Red White Yellow
Characteristic:	FL 4 FL 6	FL 4 FL 6	FL 2.5 (0.3s)	FL 2.5 (0.3s)	FL(2+1)6	FL(2+1)6 FL (2) 5	Q	Q Mo (A)
Oklahoma City, OK	701	701	701	701	701	701	701	702
Memphis, TN	701	701	701	701	701	702	702	702
Huntsville, AL	701	701	701	701	701	702	702	702
Chattanooga, TN	701	701	701	701	701	702	702	702
St Louis, MO	701	701	701	701	701	702	702	702
Kansas City, MO	701	701	701	701	701	702	702	702
Moline, IL	701	701	701	702	701	702	702	702-5
Minneapolis, MN	701	701	701	702	701	702	702	N/A
Evansville, IN	701	701	701	701	701	702	702	702
Indianapolis, IN	701	701	701	702	701	702	702	702-5
Louisville, KY	701	701	701	702	701	702	702	702-5
Cincinnati, OH	701	701	701	702	701	702	702	702-5
Pittsburgh, PA	701	702	701	702	701	702	702	N/A
Massena, NY	701	702	701	702	701	702	702	N/A
Rochester, NY	701	702	701	702	702	702	702	N/A
Buffalo, NY	701	702	701	702	702	702	702	N/A
Erie, PA	701	702	701	702	702	702	702	N/A
Cleveland, OH	701	702	701	702	702	702	702	N/A
Toledo, OH	701	702	701	702	701	702	702	N/A
Detroit, MI	701	702	701	702	702	702	702	N/A
Alpena, MI	701	702	701	702	702	702	702	N/A
Traverse City, MI	701	702	701	702	702	702	702	N/A
Muskegon, MI	701	702	701	702	702	702	702	N/A
Chicago, IL	701	702	701	702	701	702	702	N/A
Milwaukee, WI	701	702	701	702	701	702	702	N/A
Green Bay, WI	701	701	701	702	701	702	702	N/A
Sault Ste Marie, MI	701	702	701	702	702	702	702	N/A
Houghton, MI	701	702	702	702	702	702-5	702-5	N/A
Duluth, MN	701	702	701	702	701	702	702	N/A
Internat'l Falls, MN	701	702	701	702	702	702	702	N/A
Salt Lake City, UT	701	701	701	702	701	702	702	702-5
Reno, NV	701	701	701	701	701	702	701	702
Las Vegas, NV	701	701	701	701	701	701	701	702
San Diego, CA	701	701	701	701	701	701	701	702

- Notes: 1. Numbers in table refer to Carmanah Model number.
2. "N/A" means that no Carmanah can provide the desired characteristic.
3. If a desired characteristic is not listed contact Commandant (G-SEC-2).
4. Contact Commandant (G-SEC-2) for sizing information for seasonal aids.

Data Sheet 6-E(24). (cont'd).

6.E.

Table 6-24
Carmanah Solar Sizing Table (continued)

Color:	Green	Red White Yellow	Green	Red White Yellow	Green	Red White	Green	Red White Yellow
Characteristic:	FL 4 FL 6	FL 4 FL 6	FL 2.5 (0.3s)	FL 2.5 (0.3s)	FL(2+1)6	FL(2+1)6 FL (2) 5	Q	Q Mo (A)
Long Beach, CA	701	701	701	701	701	701	701	702
Los Angeles, CA	701	701	701	701	701	701	701	702
Santa Maria, CA	701	701	701	701	701	701	701	702
San Francisco, CA	701	701	701	701	701	702	702	702
Arcata, CA	701	701	701	702	701	702	702	702-5
North Bend, OR	701	702	701	702	701	702	702	N/A
Astoria, OR	701	702	702	702	702	N/A	702-5	N/A
Portland, OR	701	702	702	702	702	N/A	N/A	N/A
Pendleton, OR	701	702	701	702	702	702	702	N/A
Quillayute, WA	701	702	702	702	702	N/A	N/A	N/A
Seattle, WA	701	702	702	702	702	N/A	N/A	N/A
Annette, AK	702	N/A	702	N/A	N/A	N/A	N/A	N/A
Yakutat, AK	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Anchorage, AK	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kodiak, AK	702	N/A	702	N/A	N/A	N/A	N/A	N/A
Cold Bay, AK	702	N/A	702	N/A	N/A	N/A	N/A	N/A
King Salmon, AK	702	N/A	702-5	N/A	N/A	N/A	N/A	N/A
Bethel, AK	702-5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nome, AK	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Hilo, HI	701	701	701	701	701	701	701	702
Kahului, HI	701	701	701	701	701	701	701	702
Honolulu, HI	701	701	701	701	701	701	701	702
Lihue, HI	701	701	701	701	701	701	701	702
Guam	701	701	701	701	701	701	701	702

- Notes: 1. Numbers in table refer to Carmanah Model number.
 2. "N/A" means that no Carmanah can provide the desired characteristic.
 3. If a desired characteristic is not listed contact Commandant (G-SEC-2).
 4. Contact Commandant (G-SEC-2) for sizing information for seasonal aids.

Lantern Service Life. LED lanterns generally do not burn out, but light output degrades over time to a point that the light may not meet the operational range. Therefore lanterns shall be removed from service according to the following schedule:

Duty Cycle	Service Life (nighttime operation)
10% to 29%	12 years
30%-100%	8 years

Data Sheet 6-E(24). (cont'd).

6.E.

Battery Service Life. Schedule replacement of the battery pack to coincide with the service life of the lantern, not to exceed 4 years. For example, a FL 6 rhythm has a 10% duty and a service life of 12 years. Schedule replacement of the battery pack at 4-year intervals.

Dimensions and Weights. The overall dimensions of the 701, 702 and 702-5 lanterns are illustrated in figure 6-62. The weight is approximately 12 lbs for the 701 lantern and 17 lbs for the 702 and 702-5.

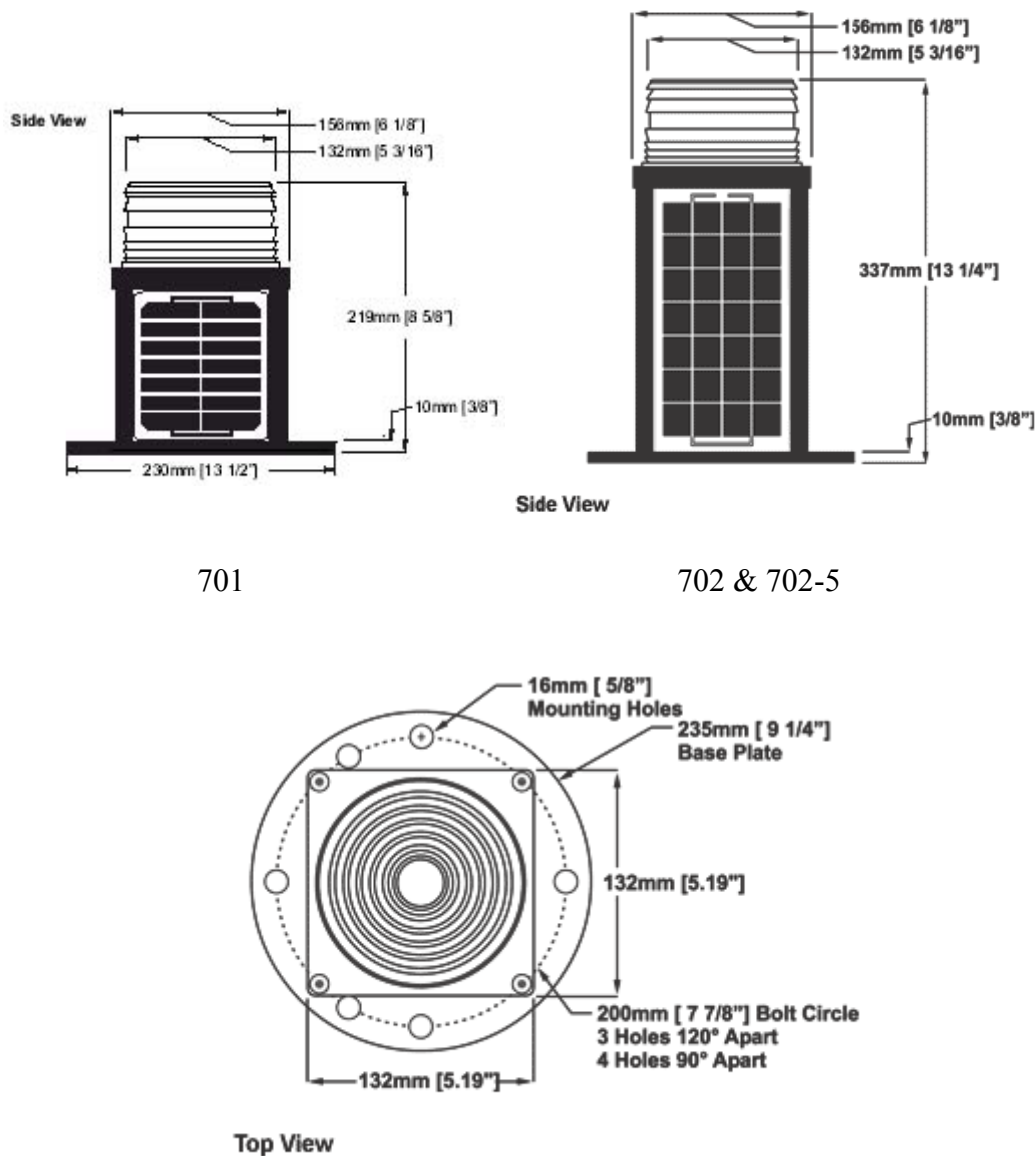


Figure 6-62. 701, 702 and 702-5 Carmanah Lanterns

Data Sheet 6-E(24). (cont'd).

6.E.

Charging, Programming, Installation and Maintenance. Information on charging, programming, installing and maintaining the Carmanah lanterns can be found in the Carmanah 700-series Technical Data Sheet which is available on the Ocean Engineering Website (<http://www.uscg.mil/systems/gse/gse2>) under “Products and Services.”

Procurement. Carmanah 700-series LED Lanterns are manufactured by Carmanah Technologies Inc., Building 4, 203 Harbor Road, Victoria, British Columbia, Canada V9A 3S2, phone: (877) 722-8877, Website: <http://www.carmanah.com>. Lanterns may be purchased on-line or by phone using a Government credit card. The buyer determines the model number (701, 702, or 702-5) using the Carmanah Solar Sizing Table in this Data Sheet. The buyer specifies the color (red, green, white or yellow), depending on the intended location. An optional bird spike may be purchased for 701 and 702 lanterns for an additional \$15.00 (specify when ordering). The new bird spike cannot be retrofitted on existing lanterns, however a clamp-on version is available from Carmanah.

Coast Guard units should buy Carmanah products using a General Services Administration (GSA) contract. Details of the contract, including prices and ordering information are specified in the Carmanah 700-series Technical Data Sheet which is available on the Ocean Engineering Website (<http://www.uscg.mil/systems/gse/gse2>) under “Products and Services.”

7.C.3.b.(1).

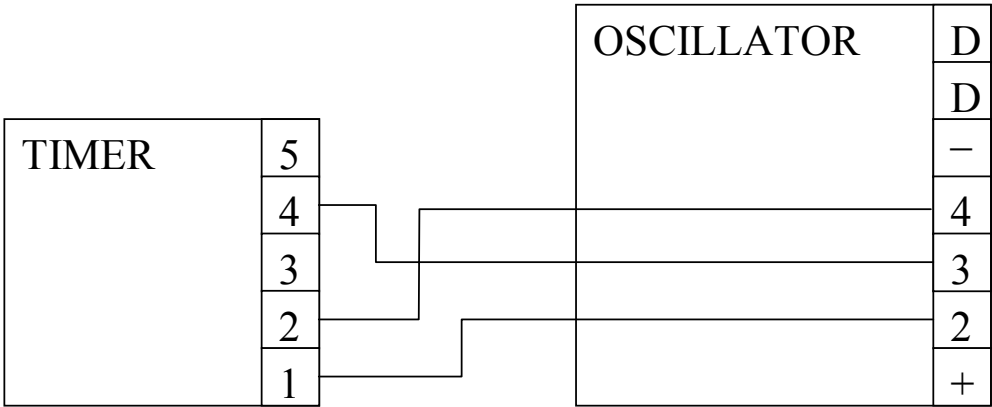
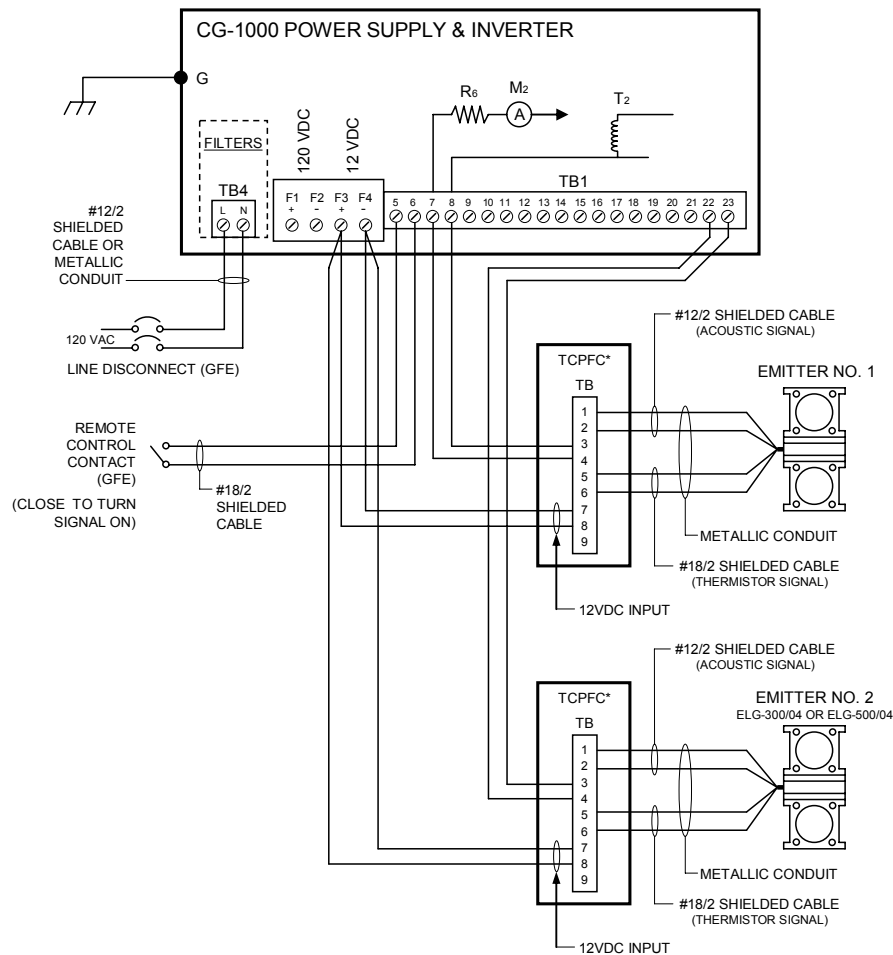


Figure 7-8A. Wiring diagram for the FA-232/SA-850 Timer and Oscillator.

7.C.3.b.(1).

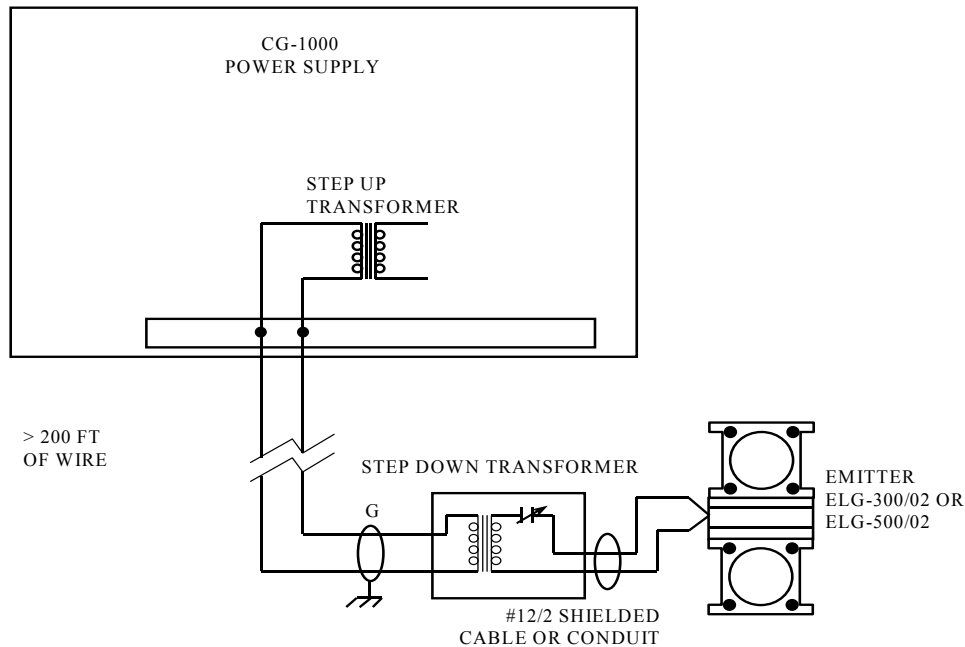


Note: When using the temperature-controlled power factor corrector, remove the power factor capacitors from the CG-1000 power supply and put them into the power factor corrector cabinet.

*Temperature-controlled power factor corrector.

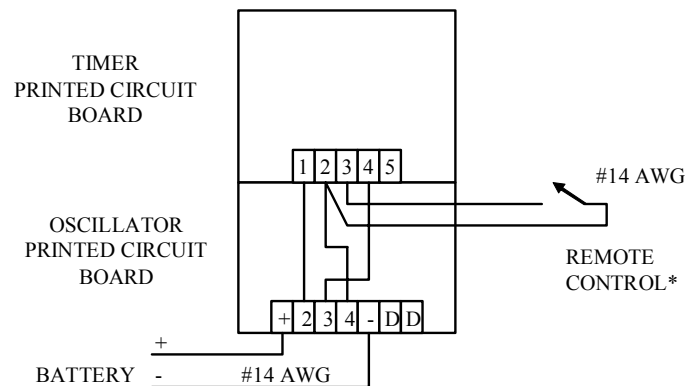
Figure 7-17. Wiring diagram for the temperature-controlled power factor corrector added to the CG-1000 system for the ELG-300/04 or ELG-500/04.

7.C.3.b.(1).



Note: When these transformers are used, the power factor capacitors must be moved from the power supply location to the emitter location. A watertight NEMA enclosure shall be used for this purpose.

Figure 7-18. Wiring diagram for a step up/step down transformer pair.



*Close contact to turn signal off.

Note: If continuous operation is desired, the remote control switch must be normally open.

Figure 7-19. Remote control connections for the FA-232 (puretone), SA-3C and the SA-850.

9.B.2.c.(3)(e)

- (e) Activation. All primary batteries, with the exception of dry cell batteries (ice batteries) require air to function. Remove sealing tape covering vents prior to use (including buoy power units).

(4) Special Applications.

- (a) Ice Buoys. Especially designed dry-cell type primary batteries (Data Sheet 9-E(21) are authorized for use in ice buoys. These batteries have a very short shelf life and for this reason, their storage is limited to one season (regardless if whether they are used). Ice buoys do not have vented pockets because they frequently submerge and this, together with the shock loads encountered, precludes the use of air-depolarized batteries. Table 9-6 provides calculated RBDTs for standard lamp/flasher combinations used on ice buoys.
- (b) Emergency Use. Surplus ice buoy batteries can be used as emergency temporary power sources (Hot Packs) on aids to navigation if:
- An accurate RBDT record exists which permits projection of expected remaining service life, and;
 - The battery output voltage is greater than 11.0 volts when load tested in accordance with the Short Range Aids to Navigation Servicing Guide, COMDTINST M16500.19 (series).

Table 9-6
Ice Buoy Battery RBDT
(months + days)

Rhythm	MPV-LED Lantern	
	Red/White/Green	Yellow
Fixed	2 + 22	2 + 6
Oc 4	3 + 19	2 + 28
Iso 6	5 + 14	4 + 13
Fl(2)6	8 + 8	6 + 21
Q	9 + 3	7 + 11
Mo(A)	8 + 8	6 + 21
Fl (2)5	17 + 2	13 + 25
Fl (2+1)6	18 + 7	14 + 23
Fl 2.5(.3)	22 + 23	18 + 14
Fl 4(.4)	27 + 10	22 + 5
Fl 6 (.6)	27 + 10	22 + 5

- d. Secondary Batteries. Secondary batteries are batteries that can be recharged by either a battery charger or photovoltaic (solar) array. Nickel-cadmium batteries are used to provide DC power for diesel starting, and power for emergency light and sound signals. Lead-acid batteries are used primarily on solar power aids.
- (1) Diesel Starting Batteries. 24-volt nickel-cadmium batteries are used at prime-powered (1 remaining) and commercially powered sites requiring a backup engine-generator. Twenty 1.2-volt pocket plate type cells are wired in series to achieve 24 volts. The battery is specifically designed for long float service and capable of starting a diesel engine. See Data Sheet 9-E(6).
 - (2) Emergency Batteries. 12-volt nickel-cadmium batteries are used at some commercially powered and solar powered sites to provide backup power for emergency signals. Ten 1.2-volt pocket-plate type cells are wired in series to achieve 12-volts. This battery was chosen because it retains its capacity over a long period of time (in excess of 20 years) and is capable of being float charged by a battery charger or non-standard solar panel. Battery capacity should be selected to provide a minimum of 8 days autonomy based on an 11.0-volt cutoff voltage. See the Automation Technical Guidelines, COMDTINST M16500.8 (series), for additional information. See Data Sheet 9-E(8).

9.E.

NICKEL-CADMIUM STORAGE BATTERY FOR EMERGENCY POWER



Function. The nickel-cadmium storage battery with pocket-type plates is used to supply 12-volt DC to electronic and emergency signal equipment at Category I, II and III, Solar Category I and II, and Commercial Day/Night Range Sync Transfer aids to navigation during period of main power loss. **Ten** cells are connected in series to provide 12 VDC.

Features.

- Preactivated and fully charged prior to shipment.
- Extended watering intervals (1-4 years).
- Low freezing point potassium hydroxide electrolyte.
- Replacement for ED-80, 240 and 400 batteries (individual ED cells cannot be replaced with the Sunica-Plus. The entire battery must be replaced.)

Electrical Characteristics.

- Output voltage 1.2 V per cell (nominal)
- Capacity at 120 hr rate to 1.0 VPC
 - SUN+ 90 90 amp-hrs
 - SUN+ 275 275 amp-hrs
 - SUN+ 415 415 amp-hrs
- Equalize Charge Voltage (77° F) 15.4 VDC
- Float Charge Voltage (77° F) 14.4 VDC (15.0-15.5 for solar)

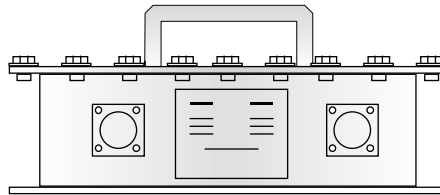
Dimensions & Weight (per cell).

	SUN+ 90	SUN+ 275	SUN+ 415
• Weight (lb)	10.8	25.4	40.4
• Height (in)	15.9	15.9	15.9
• Width	7.68	7.68	7.68
• Length (in, # of cells)	14.6 (10)	17.2 (5)	11.0 (2)

Additional Data. Sole source justifications are available from Commandant (G-SEC-2). Sunica-Plus batteries are available from: Saft America, Inc., 3 Powdered Metal Drive North Haven, CT 06473, Phone 203-239-4718, ask for your regional sales representative.

9.E.

STANDARD AIDS TO NAVIGATION POWER SUPPLY



Function. The power supply converts 120 VAC to 12 VDC power for use by DC powered aids to navigation equipment. The current, high-wattage power supply replaces all previously manufactured versions, which are no longer supported.

Features.

- Self contained in a steel case suitable for outdoor use.
- No exposed electrical contacts.
- Mil-Spec weather proof connectors for input and output.
- Automatic overload reset after fault is cleared.
- Adjustable output voltage.

Electrical Characteristics.

- | | |
|-------------------------|---------------------------------------|
| • Input voltage range | 90-145 VAC |
| • Output voltage range | 11-24 VDC (factory setpoint 12.5 VDC) |
| • Output regulation | + 0.05% of selection |
| • Ripple | Less than 2 millivolts RMS |
| • Output current | 25 amps (max). |
| • Operating temperature | -30° F to 120° F |
| • Connectors | Supplied with 10AWG pigtails |

Physical Characteristics.

- | | |
|-----------------------------------|--|
| • Case Size (L W H in inches) | 13 x 13 x 6 (including handle) |
| • Material | Stainless steel |
| • Weight | 35 lbs |
| • Mounting | Holes located on bottom plate |
| • Terminal Configuration (input) | A = Ground
B = Neutral
C = Hot (120 VAC) |
| • Terminal Configuration (output) | A = Positive (12 VDC)
B = Negative |

Additional Data. Power supplies are available from Commandant (G-SEC-2) for approved projects. This item is XB repairable through the ELC.

12-VOLT MAINTENANCE-FREE
SECONDARY BATTERY
(DELCO 2000, DELCO S-2000, DELPHI BU31SP-115S)



Function. These 12-volt, 100 amp-hour batteries may be used alone or connected in parallel to provide the proper current capacity as required by solar design program (see COMDTINST M16500.24) for use on fixed and floating aids to navigation. The Delco 2000, S-2000 and Delphi BU31SP-115S are identical in performance. The only difference is the nameplate.

Features.

- Fully charged prior to shipment.
- Designed for photovoltaic applications.
- Liquid electrolyte with semi-sealed* vent.
- Low state of charge indicator.
- Electrolyte freezing temperature at 50% state of charge: -4°F.
- Stainless steel 3/8 inch positive and negative terminals.
- Shelf life - indefinite with recharge at 6 month intervals.
- Maximum service life – 6 years.

*Vent seal will prevent splash spillage, but will leak electrolyte if tipped for an extended period.

Characteristics.

Output voltage (VDC)	12-15
Capacity at 100 hour discharge rate (amp-hours)	115
Dimensions (L W H in inches)	13 x 6-3/4 x 9-3/8
Weight (lb)	60

Additional Data. Individual Delco or Delphi batteries are available from your local warehouse. A minimum order is required for free delivery. Refer to the Ocean Engineering website <http://www.uscg.mil/systems/gse/gse2>, Products/Services, AtoN Equipment List for a list of suppliers.

9.E.

12-VOLT MAINTENANCE-FREE
SECONDARY BATTERY
(GNB SUNLYTE 12-5000)



Function. These 12-volt, 100 amp-hour batteries may be used alone or connected in parallel to provide the proper current capacity as required by solar design program (see COMDTINST M16500.24) for use on fixed and floating aids to navigation.

Features.

- Fully charged prior to shipment.
- Designed for photovoltaic applications.
- Absorbed electrolyte, spill-proof case.
- Will gas only if overcharged.
- Freeze tolerant.
- 3/8" threaded inserts for terminals.
- Rope handle for ease of transport.
- Shelf life - indefinite with recharge at 6 month intervals.
- Maximum service life – 6 years.
- Not recommended for use in hot climates.

Characteristics.

Output voltage (VDC)	12-15
Capacity at 100 hour discharge rate (amp-hours)	100
Dimensions (L W H in inches)	12-3/4 x 6-3/4 x 8-1/2
Weight (lb)	63

Additional Data. Refer to the Ocean Engineering website <http://www.uscg.mil/systems/gse/gse2>, Products/Services, AtoN Equipment List for a list of suppliers.

9.E.

ATON LABELS



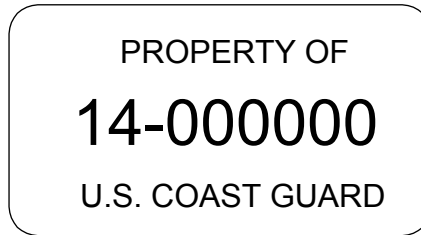
Function. The battery installation label is an optional label for use on secondary batteries to indicate the month and year the battery is installed. This provides a quick, visual indication of the age of the battery. The other labels are optional and are used to inform the public of intended use of the solar batteries and the possible fine for damaging AtoN.

Features.

- Vinyl substrate.
- Adhesive backed.
- Easily punched.

Additional. The labels are available from Nutron Nameplate, Inc., 31269 Lorrain Road, North Olsted, OH 44070-0477, Phone 440-777-6660, FAX: 440-770-6664, Internet: www.nutronnameplate.com, or from UNICOR, contact: Mr. Abe Burgess, UNICOR Federal Prison Industries, Inc., 320 First Street, NW, Washington DC 20534, Phone: 202-305-3752, FAX: 202-305-7354, email: aburgos@central.unicor.gov

BATTERY TRACKING LABEL



Function. The battery tracking label is a mandatory label for use on minor aid secondary batteries to document them from “cradle to grave”. Battery tracking labels are installed on a battery upon receipt, document where the battery is (physically) and updated as the battery moves from the unit to the aid and finally disposal.

Features.

- Vinyl substrate.
- Adhesive backed.
- Waterproof adhesive
- Sequentially numbered by district.

Additional. The battery tracking labels are available from Nutron Nameplate, Inc., 31269 Lorrain Road, North Olsted, OH 44070-0477, Phone 440-777-6660, FAX: 440-770-6664, Internet: www.nutronnameplate.com, or any local nameplate company using the statement of work available from Commandant (G-SEC-2A).

9.E.

CAT V LOAD CENTER



Function. The CATV Load Center is used in 12 VDC lighthouses to provide a simple load center to protect circuits provide disconnects for up to pieces of equipment. The center does not have provisions for emergency signals nor emergency power systems; use a Solar Distribution Box (SDB) for aids with this hardware.

Features.

- Fiberglass NEMA 4X (raintight).
- 20 amp circuit breaker protection.
- Input terminal block accepts up to 1/0 AWG wire.
- Main light terminal block accepts up to 1/0 AWG wire
- Three remaining terminal block accepts up to 10 AWG wire.
- Size: (L W D) 14" x 10.5" x 7.5"

Additional Data. CAT V Load Centers are stocked at the ELC warehouse, are Headquarters controlled and available for approved projects. Requests for CAT V Load Centers shall be addressed to Commandant (G-SEC-2). See www.uscg.mil/systems/gse/gse2, look under Products/Services, Aids to Navigation Equipment List for ordering information.

9.E.

9.E.

LARGE LEAD-ACID BATTERY (Classic OPzS Solar)



Function. These lead acid batteries are connected in series of six 2-volt cells to supply 12-volts DC to power fixed solar powered aids to navigation requiring more than 400 amp-hours. Exide Corporation imports these cells from France, therefore ensure adequate lead-time is planned when scheduling a project. The Classic OPzS are identical in construction to the discontinued Yuasa EI/EJ/FHGS cells and Fulmen Solar.

Features.

- Clear plastic case.
- Shipped filled with liquid electrolyte.
- Dry wet charged batteries are also available.
- Supplied with interconnection straps.
- Sizes from 550 Ah to 4600 Ah.
- Carrying device is needed for heavier cells.
- Fragile cell jars require careful handling and rock steady platforms.
- Freshening charge required on-site.
- Semiannual/annual watering required.
- Most reliable technology.
- Service life 10+ years

9.E.

Characteristics.

TYPE	NOM A.H. CAPACIT Y	Dimension per Cell (6 required)				INTERNAL RESISTANCE mΩ*
		LENGTH In.	WIDTH In.	HEIGHT In.	WEIGHT Lbs.	
OPzS 550	550	5.35	8.19	20.47	58	0.63
OPzS 660	660	6.18	8.19	20.47	68	0.56
OPzS 765	765	7.01	8.19	20.47	78	0.50
OPzS 985	985	6.18	8.19	27.36	97	0.47
OPzS 1080	1080	6.18	8.19	27.36	101	0.43
OpzS 1320	1320	8.86	7.60	27.36	132	0.30
OpzS 1410	1410	8.86	7.60	27.36	139	0.27
OpzS 1650	1650	8.86	9.25	27.36	161	0.26
OpzS 1990	1990	8.86	10.91	27.36	190	0.23
OpzS 2350	2350	8.86	10.91	33.27	238	0.24
OpzS 2500	2500	8.86	10.91	33.27	251	0.22
OpzS 3100	3100	8.86	15.75	32.09	332	0.16
OpzS 3350	3350	8.86	15.75	32.09	348	0.14
OpzS 3850	3850	8.86	19.29	32.09	405	0.12
OpzS 4100	4100	8.86	19.29	32.09	420	0.11
OpzS 4600	4600	8.86	2.83	32.09	477	0.11

*May be used later to determine the health of the battery.

Additional Data. Classic OPzS cells are ordered from your nearest Exide distributor. Refer to the Ocean Engineering website <http://www.uscg.mil/systems/gse/gse2>, Products/Services, AtoN Equipment List for a list of suppliers.

9.E.

LARGE LEAD-ACID BATTERY (Sonnenschein Dryfit A600)



Function. These lead acid batteries are connected in series of six 2-volt cells to supply 12-volts DC to power fixed solar powered aids to navigation requiring more than 400 amp-hours. The cells contain gelled electrolyte housed in steel cases. This technology is sensitive to overcharge and therefore longevity is not as good as wet type batteries, but considered better than “absorbed” (Absolyte) batteries, however their construction is suitable for “active” platforms, Exide Corporation imports these cells from Germany, therefore ensure adequate lead-time is planned when scheduling a project.

Features.

- Plastic case.
- Shipped filled with liquid electrolyte.
- Supplied with interconnection straps.
- Sizes from 500 Ah to 3500 Ah.
- Carrying device is needed for heavier cells.
- Durable cell containers can be installed on active platforms.
- Freshening charge required on-site.
- Spillproof technology.
- Service life 10+ years.

9.E.

Characteristics.

TYPE	NOM A.H. CAPACITY	Dimension per Cell (6 required)			
		LENGTH* In.	WIDTH In.	HEIGHT In.	WEIGHT Lbs.
6/500	500	5.79	8.19	18.7	80
7/600	600	6.61	8.19	18.7	92
6/720	720	5.79	8.19	25.59	110
8/960	960	8.46	7.6	25.59	150
10/1200	1200	8.46	9.25	25.59	180
12/1400	1400	8.46	10.91	25.59	213
12/1700	1700	8.46	10.91	31.5	264
16/2300	2300	8.46	15.75	30.51	352
20/2900	2900	8.46	19.29	30.51	440
24/3500	3500	8.46	22.83	30.51	528

*Per 12 volt battery

Additional Data. Sonnenschein Dryfit cells are ordered from the Exide Corporation. Refer to the Ocean Engineering website <http://www.uscg.mil/systems/gse/gse2>, Products/Services, AtoN Equipment List for a list of suppliers.